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THE KALEVALA.

By EDWARD CLODD.

III.

IN the opening Rune, the singer tells how an impulse beyond control drives him faster than tongue can speak or teeth can open to chant the legends of olden days, learned on his father's knee and at his mother's side as she turned the spindle.

Meeting a brother-bard in the dreary Northland, the land of Pohja, he invites him, after the custom already described, to friendly combat of song, to clasp hand in hand, and join finger to finger, as they recite the runes whose inspirations are the noble deeds of heroes a little less than gods and more than men, and the all-surrounding earth and sky. These beauteous songs are taken, the Runaio tells us—

> From the belt of aged Wäino,
> From the forge of Ilmarinen,
> From the sword of Lemminkainen,
> From the bow of Joukahainen,
> From the borders of Pohjola,
> From the heaths of Kalevala;

nor from these alone. They are no hothouse products, but are watered by the stream and freshened by the breeze. They were "gathered in the depths of the copses, blown from the branches of the forest, culled among the plumes of the pine-trees. These lays came to me as I followed the flocks in a land of meadows honey-sweet, and of hills crowned with golden flowers. The cold has spoken to me, and the rain has told me her runes; the winds of heaven, the waves of the sea, have spoken and sung to me; the wild birds have taught me, the music of many waters has been my master." Nor will the Runaio disdain more prosaic stimulus. The song shall flow the faster for the strengthening beer he quaffs, but, failing that, he will make music the long night through "with water only."

After this proem the story begins.

Luonotar, *i.e.*, "Daughter of Nature," Virgin of the Breezes, weary of her long maidenhood, descended from her dwelling in the "far-extending desert" of the vacant air to the ocean, where the tempest rocked her and the waves played round her for seven hundred years. All this time she bore within her the storm-begotten hero Wäinämöinen. Unable to give birth to him, she cried to Ukko, the Heaven-Father, for relief from her burden and her travail, but her prayer was not granted. Seeing a wild duck flying in search of a spot whereon to build its nest, she raised her knee above the water, when the bird, thinking it was a grass-covered hillock, alighted and laid in it seven eggs, six of which were of gold and the seventh of iron. As the duck brooded, the mystic Daughter felt hot pain in her knee, which caused her to start, when the eggs rolled into the sea and were broken.

> Sunk in slime they do not perish,
> But are beauteously transfigured,
> Fair the forms of all the fragments.

Some hiatus occurs here, for nothing is said as to the fate of more than one egg, which, divided, became the heaven and the earth:

> Of the yolk was made the beauteous
> Sun that lighteth up the day-time;
> Of the white was made the pale clear
> Moon that shineth in the darkness;
> Of the bright specks formed the stars were,
> And of black specks clouds uplifted.

The great mundane, self-developing egg occurs among the Hindu and other Eastern peoples, but is not found among the creation myths of Northern Europe, and its presence in the Kalevala points to it as a primitive relic of myth common to the Asiatic ancestors of the Mongol-Tartaric races—perhaps common to yet more remote ancestors, from whom Aryan and non-Aryan are alike descended. In the Indian cosmogony, Brahma, the self-existent, "desiring to produce various creatures from his own body, first, with a thought, created the waters, and deposited in them a seed. This seed became a golden egg, resplendent as the sun, in which he himself was born as Brahma, the progenitor of all worlds."* In Longfellow's "Hiawatha," he describes the representation of Gitche Manito, the Mighty, in picture-writing, as follows:—

> He, the Master of Life, was painted
> As an egg, with points projecting
> To the four winds of the heavens.
> Everywhere is the Great Spirit,
> Was the meaning of this symbol.†

For ten years Luonotar floated on the "slumber-silent billows," and the "misty ocean-barriers," before she began to press the ocean billows and uplift the everlasting hills. Then at the stretching forth of her hand the land arose, at the planting of her foot the sea deepened, at her word the ocean bights, the crags, the hidden reefs, the islands and the plains appeared.

In other, and perhaps older, versions of the epic the creation is described to Wäinämöinen, who, like Vannemuinen in the Kalevipöeg, old from his birth, is described throughout the Kalevala as *Vaka Vanha*. *Vanha* is "old," but *Vaka* has several meanings, of which, in view of the characteristics of the hero, "steadfast" is perhaps the best. In the Swedish translation he is sometimes called "wise and aged"; in the German "old and truthful" (*wahrhaft*), which is wrong; whilst the French version chooses the more unsuitable and unrhythmic word, "imperturbable."

For thirty years more Wäinämöinen remained pent up within Luonotar, fretting at the fate which hid him from the sunlight, and devising way of escape.

He besought the sun, moon, and the Great Bear in turn to deliver him, but in vain; whereupon he freed

* Muir's "Sanskrit Texts," iv., p. 27.
† Canto xiv., "Picture-Writing."

himself by tearing open his mother's breast, and then struck out upon the ocean, on whose waters he swam to and fro for eight years, till at last he reached a nameless, treeless, voiceless land.

Thus the birth of Wäinämöinen;
Thus the birth of the great singer;
Born he was of mighty parent;
Born of Ilmatar, his mother.

Then, after much pondering, he wondered who should sow the life-giving seed, when Pellerwoinen appeared, scattering seeds broadcast, whence sprang all kinds of trees, the berried junipers, the cone-laden firs, the water-nourished alders, "every tree after its kind," save the oak. Now in a far-off, mist-veiled meadow, Wäinämöinen espied five maidens mowing, and, as they raked the grass together, one Turas, a giant, rose from the ocean, and ignited the grass by rubbing it, then wrapped an acorn in a love-leaf, and buried it in the ashes. Quickly grew and spread the oak therefrom until its boughs arrested the clouds in their courses, and its leaves blotted out the light of sun and moon. Wäinämöinen, "old and steadfast," wondered whether hero or giant might be found who could fell the tree, and, in his need, went to his mother (we find the heroes of the Kalevala repairing to their mothers in all times of trouble), and besought her to lend him the ocean's strength to rid the earth of the evil-working tree. Then out of the sea came a copper-clad dwarf, a span in length, who held in his hand a copper axe. Making known his business to Wäinämöinen, who laughed scornfully at the idea of so small a man doing so great a deed, the dwarf suddenly became a giant, whose head reached to the clouds. Planting his foot firm in earth, he struck the oak with his axe, when the mighty tree staggered and fell. Its trunk lay eastward, its top pointed westward, its leaves bent southward, and its branches northward. He who took a twig had with it abiding happiness; he who gathered from the top had magic power for ever; with him who plucked a leaf dwelt everlasting charm; while the splinters which were drifted to the feet of the Northland maiden were fashioned into arrows by the sorcerer's art. And the earth was again touched by the sunshine, the clouds drifted unhindered, the birds sang, the grass and flowers grew—

All things fair and lovely flourished,
All things save the one most precious
Fruit of fruits, the golden barley.

Then Wäinämöinen, walking by the sea-shore, found seven grains in the sand, and these he carried to be sown near Kaleva's spring and Osmo's field. As he went thither a titmouse sang from the tree-top:

Osmo's barley will not flourish,
Nor Kaleva's oats be ripened;
For as yet untilled the soil is,
And uncleared is yet the forest.

Then Wäinämöinen, after the manner of culture-heroes of other races, cut down the trees, sparing only one birch-tree, that therein the birds might make melody and the cuckoo build its nest. For this a grateful eagle brought him fire wherewith to burn the felled trees, and as the hero cast the barley grains into the cleared ground he invoked the sleeping earth to awake and nourish the seed, and prayed to Ukko, Heaven-Father, to water it with the rain-clouds:

Bid them all their sweetness sprinkle,
That the ear may lift its treasure,
And the corn with plenty rustle.

Ukko granted his prayer, and in three days the barley was ready for the reaper. Then came the cuckoo, bird of spring, and, learning why the birch-tree was spared, did Wäinämöinen's bidding, and sang with a voice that gladdened the hearts of men.

Among the many barbaric myths accounting for the fitful, and startling, and turbulent in Nature, the wind and thunder are alike conceived of as caused by a monster bird, whose course is as the lightning-flash, and who is the messenger between heaven and earth, with the gift of fire to men.

In the eagle, as fire-bringer, a note in primitive thought is struck, although, as will be seen hereafter, fire itself is personified, eluding pursuit and working havoc. Another note is also struck, but softer in contrast to the often harsh melody of the Kalevala, in this communion of man with the bird of the air and the beast of the field, as sharers of a common life, given by the great Earth-mother. The presence of this in myth and folk-tale may suggest to us that if we have gained much through larger knowledge of her works and ways, the familiarity has tended to deaden sympathy with all life lower than our own, and that to quicken this anew within us is to touch the science of to-day with the poetry of the past.

HOW TO TRISECT AN ANGLE.

By Alfred Jukes Allen.

ONE of the problems made famous in the history of Geometry by its persistent refusal to admit of any solution, even at the hands of the most skilful mathematicians, is that which requires the trisection or division into three equal parts, *by Euclidian methods*, of any given angle. The Postulates of Euclid, it will be remembered, allow only the use of an instrument for drawing straight lines (such as a ruler), and of a pair of compasses for describing circles. It is now admitted—indeed, it can be proved—that with these instruments alone, the solution of the above problem is impossible, and that no combination of circles and straight lines can effect the desired end. If, however, we assume our ability to describe other curves besides the circle, we find no difficulty at all. For instance, the combination in a suitable manner of a circle with a certain curve called an *hyperbola* "of eccentricity equal to 2," gives us a very ready means of trisecting an angle, provided we have our hyperbola already accurately described. Let us now see if the problem can be solved by the use of special instruments.

The simplest possible mathematical instrument is a rod turning round a fixed pivot, with a pencil or other tracer fixed at some point of its length—a primitive form, in fact, of a pair of compasses. By means of such an instrument very correct circles can be described. A correct *straight line*, however, if supposed to be drawn by means of a ruler, requires the previous production of a straight edge on the same—a matter of no small difficulty. Such was, doubtless, the manner in which Euclid supposed straight lines to be drawn, but it has been found of late years that the same result may be obtained by means of rods suitably pivoted together, and not involving such accurate workmanship. And further, by other combinations of simple rotation about a pivot, the trisection of angles, which defied the efforts of geometers provided only with rule and compasses, has been successfully accomplished. It is instruments of the latter class that we are now to consider.

The "fan" invented for the purpose by Professor Sylvester is shown in Fig. 1. It consists of six rods pivoted together at O, the four alternate ones of which are for convenience prolonged. To each rod, at a given distance from O, is pivoted a link, all (except the two end

ones) being equal, and divided by the pivots in the same ratio, and all jointed together as shown. Thus we have the first link on the left side equal to the first part of the second link, so that, in all positions, angle (1) = angle (2); the remainder of the second link equal to the first part of the third, so that angle (3) = angle (4), and so on. But it is evident that (2) = (3). Therefore, we have (1) = (2) = (3) = (4), which = (5), and so on, all the numbered

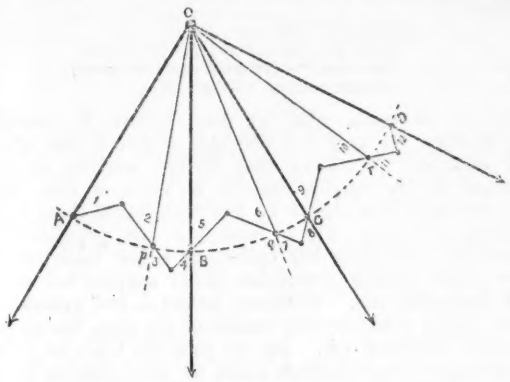

Fig. 1.

angles being equal. It will thus be clearly seen that the angles A O *p*, B O *q*, C O *r* are equal, and the angles *p* O B, *q* O C, *r* O D, also. Therefore the whole angles A O B, B O C, C O D are necessarily always equal, and hence, if A O D be made equal to any angle, either of the above is equal to one-third of that angle.

The apparatus devised by Mr. Kempe presents a somewhat different appearance. The dark lines in Fig. 2 form

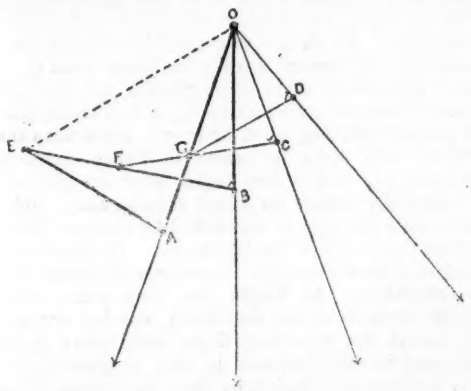

Fig. 2.

what is called a *contra-parallelogram* of rods pivoted at O, B, A, and E; E A being equal to O B, and E B to O A. The triangles O A E, E B O having three corresponding sides equal, we obviously have for all positions angle O A E = angle E B O, and, by a simple deduction, angle B E A = angle A O B. If, now we take a point F in B E such that O B : B F = O A : A E, and in the next long rod a point C such that O C = F B, and connect F and C by a link F C equal to O B, we evidently obtain a jointed system of a similar character to the preceding, so that, if we suppose the angles O C F, O B F to be equal to O A E or O B E, the two systems of rods form precisely similar contra-parallelograms, having their other corresponding angles equal.

Now the angles O B F, O B E are one and the same; therefore the corresponding angles C O B, B O A, must necessarily always be equal, the two contra-parallelograms being similar in all positions. In the same way, by taking C G in C F, bearing the same ratio to O C that B F does to O B, or A E to O A, and proceeding as before, we obtain a still smaller system of jointed rods, O D G C, similar in character to O C F B, and having the angle D O C necessarily always equal to the angle C O B, owing to the equality of the angles O C G and O B F = F C O. Thus we see that the angles D O C, C O B, B O A must be equal for all positions, so that this apparatus, like Sylvester's, enables us to trisect any angle, by making A O D equal to it. The apparatus has this advantage over Sylvester's, that the extent to which it may be opened is not limited; but this advantage is not great, since the trisection of an angle nearly equal to two right angles is evidently effected when the angle representing its defect therefrom has been trisected.

The two pieces of apparatus just described consist entirely of rigid rods pivoted together. The following, for which the writer is responsible, depends for its efficiency on the addition of two *springs*. It consists of two equal jointed rhombuses (Fig. 3), O A E C, O B F D, pivoted

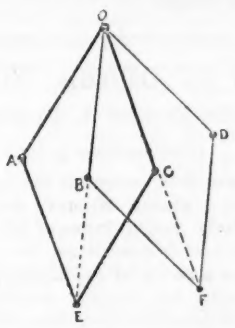

Fig. 3.

together at O. B is connected with E, and C with F, by some kind of springs (shown by dotted lines), the effect of which is to keep B in a line with O and E, and C in a line with O and F. Now, a rhombus consisting of four equal sides, the diagonal O E bisects the angle A O C, and the diagonal O F bisects the angle B O D. If, then, B always lies on O E and C on O F, it is evident that, considering the dark rhombus, the angle B O C is equal to B O A for all positions, and to C O D, considering the other rhombus. Thus O B, O C always divide the angle A O D into three equal parts. No difficulty will be found in making the above apparatus, the rods (which may be of sheet brass) being all equal in length; the springs B E, C F, may be stretched between rings slipped over the pivots at B, E, C, and F, their tension being of little importance. Two more links, C G, D G, forming a third rhombus O C G D, enable us to divide an angle into *five* equal parts; for, the angle C O G being half of C O D, is one quarter of A O C, and is therefore one-fifth of A O G in all positions.

Another trisection apparatus, also due to the writer, may be mentioned, which involves the use of a single rhombus, such as O A E C in the last figure, a lamp and a small plane mirror.

We will suppose that the operation is conducted in a darkened room, the trisection depending on the reflection of a beam of light from the mirror, which is set perpendicular to the rhombus, and is capable of turning about O so that the apex of the angle A O C always lies on its

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surface. A covered spirit or other lamp is placed on the link O C, and sends a beam of light through a small hole on to the mirror at O. The link O A is fixed, and O C is revolved about O till A O C is equal to the angle to be trisected. This done, the *mirror* is revolved till the reflected beam from the lamp passes along O A, and it is then clamped firmly to O A. It is evident now that if C is moved towards A, the beam and its reflection approach each other also, the latter describing the same angle from O A as O C describes from its first position, which may be supposed to be O D. The trisection is effected when the reflected beam is observed to pass through E; for then we have angle D O C described by the beam = angle A O E described by the reflected beam. But A O E = C O E by the nature of the rhombus, so that the angle through which O C has been turned is one-third of the given angle. This apparatus is inferior to the preceding in requiring an accurately planed surface and careful mounting for the mirror.

We see, then, that the problem of the trisection of an angle may be solved in more ways than one by mechanical means, the required instruments consisting only of pivoted rods, with, in one case, the addition of tension to keep three points in a straight line.

LIFE IN OTHER WORLDS.

By Richard A. Proctor.

(*Continued from p. 164.*)

AND while we thus recognise throughout our earth's history as a planet, Nature's apparent purpose of providing infinitely varied forms of life at all times and under the most varied conditions, we also perceive that Nature possesses a power of modifying the different types in accordance with the varying conditions under which they subsist. Without entering here into the vexed question of the actual extent to which the principle of selection operates, we must admit that it does operate largely, and that it must necessarily cause gradual change of every type of living creature towards the most suitable form. This particular operation of Nature must certainly be regarded as an apparent carrying out of the purpose attributed to her,—by our manner of speaking when we say that Nature's one great object is the support of life. If types were unchangeable, life would come to an end upon a globe whose condition is not only not unchangeable, but changes largely in the course of long periods of time. But types of life change, or can change when required, at least as quickly as the surrounding conditions—save in the case of certain catastrophes, which, however, never affect any considerable proportion of the earth's surface.

Nor is it easy to assign any limits to this power of adaptation, though we can scarcely doubt that limits exist. The earth may so change in the course of hundreds of thousands of years to come that none of the chief forms of life, animal or vegetable, at present existing, could live even for a single year under the changed conditions of those distant times, while yet the descendants of creatures now living (including man) may be as well fitted to the circumstances around them as the most favoured races of our own time. Still there must be a limit beyond which the change of the earth's condition, whether through the cooling of her own globe or the diminution of the sun's heat, will be such that no conceivable modification of the types of life now existing could render life possible. It must not be forgotten that Nature's power of adaptation is known to be finite in many cases, and therefore must be presumed to be finite in all cases. The very process of selection by which adaptation is secured implies the continual failure of preceding adaptations. The struggle for life involves the repeated victory of death. The individuals which perish in the struggle (that is, which perish untimely) far outnumber those which survive. And what is true of individuals is true of types. Nature is as wasteful of types as she is of life—

> So careful of the type; but no,
> From scarped cliff and quarried stone
> She cries, "a thousand types are gone;
> I care for nothing, *all* shall go."

This is, in truth, what we must believe, if, reasoning by analogy, we pass but one step higher in the scheme of creation. We know that Nature, wasteful of individual life, is equally wasteful of types of life. Must we not infer that she is no less wasteful of those aggregations of types which constitute the populations of worlds? Watching her operations a few brief minutes, we might (setting experience aside) suppose her careful of individual life. Watching during a few generations, we should pronounce her careful of the type, though careless of individual life. But we perceive, when we extend the range of time through which we look, that she is careless no less of the type than of life. Why should this extension of the range of view be the last we should permit ourselves? If we pronounce Nature careful of the planetary populations, though careless of the types of life which make up such populations, we are simply declining to take a further step in the course pointed out for us by the teachings of analogy.

Let us go over the ground afresh. Individual creatures, even the most favoured, perish after a time, though the balance may long oscillate between life and death. Weak, at first, each creature which is to live grows at length to its full strength, not without vicissitudes which threaten its existence. As its life progresses the struggle continues. At one time the causes tending to decay seem to prevail awhile; at another, those which restore the vital powers. Disease is resisted again and again; at first easily, gradually with greater difficulty, until at length death wins the day. So it is with types or orders of living creatures. A favoured type, weak at first, begins after a while to thrive, and eventually attains its fullest development. But from time to time the type is threatened by dangers. Surrounding conditions become less favourable. It ceases to thrive, or, perhaps, passes through successive alternations of decay and restoration. At length the time comes when the struggle for existence can manifestly have but one end; and then, though the type may linger long before it actually disappears, its disappearance is only a question of time. Now, it is true that each type thus flourishing for awhile springs from other types which have disappeared. The favoured types of our age are but varieties of past types. Yet this does not show that types will continue to succeed each other in endless succession. For, if we consider the matter rightly, we perceive that the analogue of this circumstance is, in the case of individual life, the succession of living creatures generation after generation. And as we know that each family, however large, dies out in the long run unless recruited from without, so we are to infer that the various types peopling this earth, since they cannot be recruited from without, must at length die out, though to our conceptions the time necessary for this process may appear infinite.

To the student of science who recognises the true meaning of the doctrine that force can be neither annihilated nor created, it will indeed appear manifest that life must

eventually perish from the face of the earth; for he perceives that the earth possesses now a certain fund or store of force in her inherent heat, which is continually though slowly passing away. The sun also, which is a store-house whence certain forms of force are distributed to the earth, has only a finite amount of energy (though probably the inhabitants of the earth are less directly concerned in this than in the finiteness of terrestrial forces). Life of all kinds on the earth depends on both these stores of force, and when either store is exhausted life must disappear from the earth. But each store is in its nature limited, and must one day, therefore, be exhausted.

We have also only to consider that life on the earth necessarily had a beginning to infer that it must necessarily have an end. Clearest evidence shows how our earth was once "a fluid haze of light," and how for countless æons afterwards her globe was instinct with fiery heat, amidst which no form of life could be conceived to exist, after the manner of life known to us, though the germs of life may have been present "in the midst of the fire." Then followed ages in which the earth's glowing crust was drenched by showers of muriatic, nitric, and sulphuric acid, not only intensely hot, but fiercely burning through their chemical activity. Only after periods infinite to our conceptions could life such as we know it, or even in the remotest degree like what is now known to us, have begun to exist upon the earth.

The reader, doubtless, perceives whither these considerations tend, and how they bear in an especial manner on the opinion we are to form respecting such planets as Jupiter and Saturn on the one hand and Mars on the other. We see our earth passing through a vast period, from its first existence as a separate member of the solar system, to the time when life appeared upon its surface: then began a comparatively short period, now in progress, during which the earth has been and will be the abode of life; and after that must follow a period infinite to our conceptions when the cold and inert globe of the earth will circle as lifelessly round the sun as the moon now does. We may, if we please, infer this from analogy, seeing that the duration of life is always infinitely small by comparison with the duration of the region where life appears; so that, by analogy, the duration of life on the earth would be infinitely short compared with the duration of the earth itself. But we are brought to the same conclusion independently of analogy, perceiving that the fire of the earth's youth and the deathly cold of her old age must alike be infinite in duration compared with her period of vital life-preserving warmth. And what is true of the earth is true of every member of the solar system, major planet, minor planet, asteroid, or satellite; probably of every orb in space, from the minutest meteorite, to suns exceeding our sun a thousandfold in volume.

If we had any reason to suppose that all the planets sprang simultaneously into being, that each stage of each planet's existence synchronised with the same stage for every other planet, and that life appeared and disappeared at corresponding stages in the existence of every planet, we should be compelled to accept the theory that at this moment every planet is the abode of life. Not only, however, have we no reason to suppose that any one of these conditions exists (and not one but *all* these conditions must exist before that theory can be accepted), but we have the strongest possible evidence, short of actual demonstration, that the births of the different planets occurred at widely remote periods, and that the several stages of the different planets' growth differed enormously in duration; while analogy, the only available evidence on the third point, assures us that little resemblance can be supposed to exist between the conditions and requirements of life in different members of the solar system.

On any reasonable hypothesis of the evolution of the solar system, the eight primary planets must have begun to exist as independent bodies at very different periods. If we adopt Laplace's theory of the gradual contraction of a mighty nebula, then we should infer that the planets were formed in the order of their distances from the sun, the remoter planets being those formed first. And according to the conditions of Laplace's hypothesis, the interval separating the formation of one planet from that of its next neighbour on either side must have been of enormous duration. If we prefer the theory of the gradual growth of each planet by processes of accretion, we should infer perhaps that the larger planets took longest in growing to maturity, or preferably that (according to the doctrine of probabilities) a process which for the whole system must have been of inconceivably enormous length, and in which the formation of one planet was in no sort connected with the formation of any other, could not have resulted in bringing any two planets to maturity at the same or nearly the same time, save by so improbable a combination of fortuitous circumstances as may justly be considered impossible. If we consider that the solar system was evolved by a combination of both processes (the most probable theory of the three in my opinion), we must still conclude that the epochs of the formation of the different planets were separated by time-intervals so enormous that the duration of life upon our earth is, by comparison, as a mere second compared with a thousand years.

(To be continued.)

THOUGHT AND LANGUAGE.

By ADA S. BALLIN.

V.

I HAVE endeavoured to trace backwards to their early history the conditions of thought and language, and to show that the origin of thought may be traced to sensation, and the origin of language to the outward manifestation of the same.

Let us try to imagine how a rotifer would think if it could define its thoughts clearly. The following would, probably, be its line of argument:—"Whenever I am hungry I wriggle about my forceps, my tail, or both in search of food; when I see another fellow behaving in that way I at once conclude that he is hungry, and if he is stronger than I, not wishing to supply his dinner with my own person, I beat a retreat." We have no reason to believe that the rotifer can argue in this way, but it acts as if it does, and we have here an example of sensation—its manifestation and unconscious interpretation in one of the lowest forms of life.

If we pass now from the lowest to the highest known form of life, we may find a similar instance of *unconscious reasoning*, if such a paradoxical term is allowable. A man, seeing in another those manifestations which accompany great physical agony, *sympathises*—that is, *feels with* the sufferer. The feelings which he, himself, experienced under similar circumstances are recalled more or less feebly. The same is true of many of the lower animals, which are *compassionate*, and show fellow feeling.

The object has no meaning except in relation to the subject, so that the only knowledge an individual can obtain of mind in others is by ultimate reference to his own personal experience.

The untutored savage and the child are alike led to attribute possession of mind to inanimate things, when, owing to extraneous and unknown causes, they see apparently voluntary action take place in these. The child or the man overcome with passion, having accidentally struck himself against a chair or a table, gives the innocent piece of furniture a hearty kick by way of revenge, and when such accidents happen it is not an uncommon thing to hear the sufferer condemn a footstool or the corner of a sideboard to everlasting tortures in the lowest depths of Hades. This is apparently a survival of the animistic theory, a return to that stage of mental evolution when every *thing* was supposed to have a soul, on the grounds of some general resemblance to the life of the individual.

The same phase of mind seems to have been observed in the lower animals.

M. Comte once saw a large dog playing with a stick, and accidentally thrust one end of it against the roof of his mouth. He immediately dropped the stick, and rushed away in a state of abject terror, ridiculous in so large an animal, and which apparently arose from his thinking that his whilcome plaything had suddenly come to life. An analogous case is related by Mr. Herbert Spencer, who had a Skye terrier, which, like others of his kind, was in the habit of playing with bones, worrying them, and pretending they were alive. On one occasion, Spencer tied a fine thread to one of the bones, and dragged it along; the dog was evidently astonished, and looked about to find a cause for the movement; seeing none, his astonishment developed into dread, and he ran and hid himself, "to behold at a distance the 'uncanny' spectacle of a dry bone coming to life." In the "Descent of Man," Darwin speaks of a fine dog which he observed barking at a parasol that was being moved by the wind along the lawn, and behaving exactly as if he thought it was alive.

In my last article, I classified gestures under three heads, the first of which includes the expression of feelings—that is to say, sensations and emotions. These are distinguished from the other two classes in that they are not intentionally performed for the purpose of impressing the onlooker; but are instinctive, and take place equally when no observer is present. Those, however, who witness them may, none the less, endow them with a meaning in relation to their own feelings. Thus, one may laugh, or sigh, or blush, in the seclusion of one's own room, but if another were present he might interpret such as a sign of merriment, grief, or shame.

In his interesting work on the expression of the emotions Darwin formulates three general principles in regard to the causation of the various expressions:—

I. The principle of serviceable associated habits. Actions which have been of service under certain states of mind, tend to recur when the same state of mind is induced, however feebly, and although they may then be of no use.

II. The principle of antithesis. Opposite states of mind lead to actions directly opposed to those included under the first class.

III. The principle of actions due to the constitution of the nervous system independently of the will, and, to a certain extent, of habit. In considering the first of these principles, Darwin quotes the excellent statement of the law of association, which is given by Bain,* that "actions, sensations, and states of feeling occurring together or in close succession, tend to grow together or cohere, in such a way that, when any one of them is afterwards presented to the mind, the others are apt to be brought up in idea."

Spencer, in his "Principles of Psychology," points out that fear is expressed by just those "manifestations that would accompany an actual experience of the evil feared." The destructive passions are expressed by actions which are weaker forms of those that accompany the killing of prey. Animals in mad anger tear, break, and bite whatever comes in their way, and the same remark is true of some people. The foaming at the mouth observed in rage may, perhaps, have its origin in the increased secretion of saliva caused by the prospect of food which the prey affords. Persons in anger have still a desire to strike, the fists are clenched, and there is a general tension of their muscles similar to that of animals preparing for an attack.

The contraction of the brows, concomitant with great mental concentration, and which we interpret as the frown of thought, may be traced to the shielding of the eyes, to protect them from too much light, while an enemy or prey was being intently watched; and this theory of the origin of the expression finds support in the fact that during concentrated thought the pupils of the eyes contract as they do in strong light.

Darwin maintains* that all those expressions included under his first principle "were at first voluntarily performed for a definite object; namely, to escape some danger, to relieve some distress, or to gratify some desire. For instance," he says, "there can hardly be a doubt that the animals which fight with their teeth have acquired the habit of drawing back their ears closely to their heads when feeling savage, from their progenitors having voluntarily acted in this manner in order to protect their ears from being torn by their antagonists; for those animals which do not fight with their teeth do not thus express a savage state of mind."

Other such expressions are those of disgust, which have their origin in the endeavours to stop the nose against, or turn away from, a bad smell, and in the actions which take place in spitting out a nauseous morsel and in vomiting. The characteristic expression of disdain, what we call turning up the nose, is, Darwin suggests, derived from the habit of exposing the canine tooth when animals snarl at one another.

Darwin's second principle, that of antithesis, is less important than the two others. The chief example which he gives under this head is that of a dog, who, seeing a man approaching, prepares, with savage growl, exposed teeth, ruffled hair, and ears pressed back, to spring on an enemy; but discovering that the approaching person is his master, his whole bearing is instantly reversed. "Instead of walking upright, the body sinks downwards, or even crouches, and is thrown into flexuous movements; his tail, instead of being held stiff and upright, is lowered and wagged from side to side; his hair instantly becomes smooth; his ears are depressed and drawn backwards, but not closely to the head; and his lips hang loosely."† The majority of expressions which might be classed under this head are probably referable to the third principle, which is in reality the most important, and largely influences both the others.

As Spencer has shown,‡ feeling which passes a certain pitch habitually vents itself in bodily action; and further, "an overflow of nerve force undirected by any motive . . . will take first the most habitual routes; and if these do not suffice, will next overflow into the less habitual ones."

Under this third principle, that of the direct action of the nervous system, may be classed all those expressions where under excitement nerve-force is generated in excess

* "Senses and the Intellect," 2nd Ed. p. 332.

* "Expression of the Emotions," ed. 1872, pp. 353–4.

† "Exp. of Emotions," p. 51.

‡ "Essays, Scientific, Political, and Speculative." Second series. 1863. p. 111.

and transmitted in various directions, as when a child laughs, stamps, shouts, and claps its hands with joy, or where it is quite inhibited, as when a person or animal is *paralysed* by fear or astonishment.

THE WORKSHOP AT HOME.

BY A WORKING MAN.

THERE is a very effective way of constructing library furniture, which I will describe and illustrate to-day, by showing how to make a writing-table. The amateur who thoroughly masters my instructions will have no difficulty in applying them to the construction of chairs to match the table. The peculiarity of this style of table is that its legs are crossed, or X shaped. We may use either "red (really yellow) deal" or pitch pine for this, and for good solid work it should be 1½-in. stuff. Fig. 40 shows an end view of the table. L L are the legs, which may be sawn with the bow-saw out of 1½-in. board, 6 in. wide when planed up. They are "halved" into each other (see p. 403 of the last Volume) at M. In the middle of the part where they cross, a vertical mortice will have to be afterwards cut to receive the end of the bottom cross-bar, of which we are presently to speak. The ledger, F F, cut out of ¾-in. wood, which is to carry the top of the table, is screwed on to the upper ends of the legs. Quite obviously, the legs and ledger for the other end of the table are precise facsimiles of those we have just made. The screws, which are to

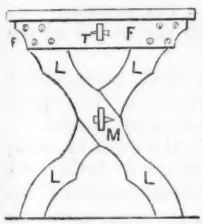

Fig. 40.

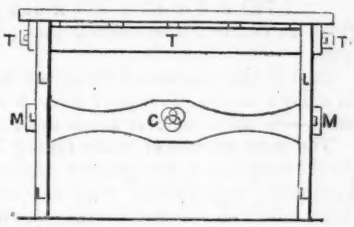

Fig. 41.

show, I may mention here, should be black, with hemispherical or rounded heads. You can buy them at the ironmongers. Through the ledgers at T are cut mortices for the ends of a top cross bar. This, with the bottom one, makes the frame extremely rigid. In the tenons themselves, projecting from the ends of these cross-bars through the junction of the legs, are mortices cut, and into these are driven wooden wedges, as shown, which hold everything tight and, as I have just said, rigid. Fig. 41 gives us a front view of the table, and further helps to explain how it is put together. Here T is the top cross-bar and C the bottom one. As we will make our table 3 ft. 6 in. long by 2 ft. 3 in. wide (a convenient size for a writing table), the length of these cross-bars may be 3 ft. or thereabouts inside, that is from one shoulder abutting against the inside the legs to the other. The projecting tenons may be 3 in. long. It only remains to make the top of our table. This, as I have said, must be made of ¾-in. "red" deal, and must be 3 ft. 6 in. long by 2 ft. 3 in. wide. The boards, carefully shot true at their edges, must be glued and cramped firmly up, and cross pieces screwed to them (with common screws, not long enough to pass through the table as well as the cross-piece). The two outside cross pieces should abut against the inside of the legs when the table top is finally screwed down on to its supporting frame. In the middle of the bottom cross-bar C will be noticed a kind of trefoil "Gothic"

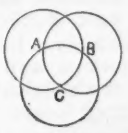

Fig. 42.

ornament. This is made with a large centre-bit, the point of the bit being successively inserted at A, B, and C in Fig. 42. The wood may be either cut clean out (in which case the cross-bar C must be laid upon a waste piece of wood into which the bit may enter, so as to cut without leaving a ragged outside edge) or merely countersunk, whichever the maker likes best. A quatrefoil or cinquefoil may be made with a centre-bit just as easily as a trefoil, in a way which must be quite obvious. Our table finished may (if it be made of red deal or pitch pine) be varnished without being stained at all, but it must, of course, be first sized (Vol. VI., p. 480). Completed thus it forms really a handsome piece of furniture.

RAMBLES WITH A HAMMER.

BY W. JEROME HARRISON, F.G.S.

IN SOUTH LEICESTERSHIRE.

(*Continued from p.* 173.)

THE lower lias beds are finely exposed in the numerous quarries eight miles north of Leicester, lying alongside the Midland line, between Sileby and Barrow-on-Soar. Here fossil saurians and fishes are of common occurrence, with myriads of bivalve shells and ammonites. Similar beds occur at Kilby Bridge, five miles south-east of Leicester. These limestones owe their special value to their power of "setting" hard under water, so that they are in great request for harbour-works, tunnels, &c. The strata of the Middle and Upper Lias, which form East Leicestershire, do not come within the scope of this article. Above both Trias and Lias, resting indiscriminately on either or both, we have that bugbear of some geologists (but the delight of others), the *Drift*—a stony clay of very variable thickness, which is the moraine left by an old glacier that formerly extended from the Lincolnshire Wolds to the northern brow of the Thames Valley. From the frequent occurrence in this particular moraine of lumps of chalk of all sizes—derived, doubtless, from the chalk hills of Lincolnshire and Yorkshire—it has received the name of the "Great Chalky Boulder Clay." A magnificent section of this boulder clay was exposed in 1875, when the Midland railway between Leicester and Wigston was widened. The stony clay was exposed for more than a mile in length in a clear, vertical section, of ten to thirty feet in height. It was a compact, slaty-blue clay, stuffed full of angular blocks of rock, in which black lumps of coal stood out in striking comparison with white masses of chalk and friable sandstone. Beneath the clay, and exposed to a depth of three or four feet only, were the Liassic limestones and shales. These had been *planed down* to a uniform level for a distance of a quarter of a mile, and oblong blocks of each limestone-band could be seen at the base of the boulder-clay, lying close to, and just south of, the bands of rock from which they were derived, telling clearly—by their polishing and striations—of the passage of ice over the surface from north to south.

All the rocks we have now described—the Trias, the Lias, and the Drift—form a tolerably level country, intersected by the Soar Valley, and averaging from 200 ft. to 400 ft. above the level of the sea. But a few miles south-west of Leicester certain rocks of much greater age appear in isolated masses of small extent, forming bosses in the Triassic plain, as they once formed islands in the Triassic sea. (See Map, KNOWLEDGE, Vol. VI., p. 517.) Getting out at Narborough Station (on the

London and North-Western Railway from Leicester to Nuneaton), five miles from Leicester, we walk northwards for a mile to the syenite quarries at Enderby. In the Lower Enderby quarry the igneous rock is seen breaking through a greenish slate, probably of Cambrian age; while *above* the syenite a very fine section of Keuper sandstone and marl is seen, the Triassic strata filling up and resting in a long hollow in the syenite. In the quarries at the top of the village—which is truly "founded upon a rock"—it is interesting to note the manner in which the syenite has weathered into immense balls. Retracing our steps to Narborough, we examine a large quarry there (the igneous rock here is not shown on the Survey Map), and then continue our walk for two miles in a south-west direction, to Croft Hill, a conical eminence which rises about 250 feet above the plain to a height above sea-level of about 500 feet. The "Huncote" quarry here is at the northern foot of the hill, and there is another large quarry near Croft Station, which lies at the southern extremity. Two miles to the west a similar rock forms the low eminence—crowned by a mill—of Barrow Hill. Less than two miles south of Croft we find the last exposure, in a southerly direction, of the syenite round the villages of Stoney Stanton and Sapcote.

At all the points named the stone is largely quarried for "setts" and "kerbs," many thousands of tons being sent annually to London and other large towns, fetching a price of from twenty to thirty shillings per ton. The stone is extremely hard and tough, rather fine-grained, varying in colour from grey to pink, and composed of the minerals felspar (pink) and hornblende (dull green), with a few grains of quartz. Generally speaking there is little real difference between the rock and the syenites of Charnwood Forest, and they may be all of the same geological age, although what that age is—except that it is certainly pre-carboniferous—is a very doubtful question. The rock at Barrow Hill shows an approach to the intrusive diorites which traverse the Hartshill range—a few miles further south. It is described by Professor Bonney as "a quartz diorite rather than a syenite."

RAIN.

By Richard A. Proctor.

THERE are, perhaps, few natural phenomena which appear less indicative, at first sight, of the operation of nature's giant forces than the downfall of rain. Even the heaviest showers—at least of those we are familiar with in England—are not phenomena which suggest an impression of power. Yet the forces actually called into action before rain can fall, are among the most gigantic experienced on our earth. Compared with them, *terrestrial* gravitation is more feeble than is the puniest infant compared with an army of giants. Let us look into the matter a little closely, and we shall see that this is so.

It is a common occurrence for rain to fall over an area of 100 square miles to a depth of one inch in twenty-four hours. Now, what is the expenditure of power of which such a phenomenon is the equivalent? The downfall is, so to speak, the loosening of the spring, but how much force was expended in winding up the spring? The evaporation from the sea or from moist soils of the quantity of water precipitated, is not the whole of the work to be estimated, since the vapour has to be raised to the higher regions of the air, and to be wafted by the winds—themselves the representatives of giant forces—to the district over which the moisture is discharged in rain. But let us take this evaporation only, and estimate its real force-equivalent. It may be shown by a calculation founded on Mr. Joule's experiments, that to evaporate a quantity of water sufficient to cover an area of 100 miles to the depth of one inch, would require as much heat as is produced by the combustion of *half a million tons of coals*; and further, that the amount of force of which such a consumption of heat is the equivalent, corresponds to that which would be required to raise a weight of upwards of one thousand millions of tons to a height of one mile! I will run briefly through the calculation by which this last result is deduced from the well-known result of Joule's experiments that to raise one pound of water one degree Fahrenheit, requires a quantity of heat sufficient to raise one pound to a height of 772 feet; and the further experimental fact, that to raise a pound of water from the liquid to the vaporous state, requires 967 times as much heat as is required to raise the same pound one degree Fahrenheit in heat.

The amount of water required to cover one hundred square miles to a depth of one inch is, in volume—

$$1{,}760 \times 1{,}760 \times 3 \times 3 \times 100 \div 12$$

cubic feet, and as one cubic foot of water weighs 1,000 oz., or nearly 63 pounds, we have in weight—

$$1{,}760 \times 1{,}760 \times 3 \times 3 \times 8\tfrac{1}{2} \times 62\tfrac{1}{2} \text{ pounds,}$$

and to raise this weight of water 1° F., would require as much heat as would suffice to raise to a height of *one mile* a weight of—

$$1{,}760 \times 3 \times 8\tfrac{1}{2} \times 62\tfrac{1}{2} \times 772 \text{ pounds;}$$

while to vaporise the same weight of water would require 967 times as much heat. Thus we obtain a force sufficient to raise a weight of—

$$1{,}760 \times 3 \times 17 \times 135 \times 193 \times 967 \text{ pounds,}$$

(that is, nearly 1,020,000,000 tons), to the height of one mile.

Such is the amount of force, whose effects are exhibited in a day's steady downpour over a region of 100 square miles—for instance, over about one-third of Middlesex.

The same amount of water falling in the form of snow, would represent a yet greater expenditure of force. "I have seen," says Tyndall "the wild stone-avalanches of the Alps, which smoke and thunder down the declivities, with a vehemence almost sufficient to stun the observer. I have also seen snowflakes descending so softly as not to hurt the fragile spangles of which they were composed; yet to produce, from aqueous vapour, a quantity which a child could carry, of that tender material, demands an exertion of energy competent to gather up the shattered blocks of the largest stone-avalanche I have ever seen, and pitch them to twice the height from which they fell."

But it is when we come to estimate the fall of rain as a terrestrial phenomenon—as a process continually going on over large regions of the earth's surface, as a process in which energies exhibited over one region are expended, frequently, over regions thousands of miles away—that we see the full significance of the drop of rain. We can well understand how it is that "the clouds drop fatness on the earth," when we estimate the powers expended in their genesis. All the coal which could be raised by man from the earth in thousands of years, would not give out heat enough to produce by evaporation the earth's rain-supply for one single year! The sun—whose influence is often contrasted with that of the rain-shower—is the agent in producing that shower as well as in pouring out his direct heat on the soil with such apparently contrasted effect.

The actual process of the production of rain has not yet been completly explained. We are, in fact, doubtful as to the true nature of clouds, fogs, and mist, and, therefore, it is intelligible that some difficulty should surround the explanation of a phenomenon of which these meteors are, so to speak, the parents.

It is generally supposed that clouds consist mainly of hollow *vesicles* of water, and not of minute drops. Yet meteorologists are far from being agreed on this point. On the one hand we have the evidence of De Saussure and Kratzenstein, who actually saw, or supposed they saw, the constituent vesicles of clouds and fogs. Dr. Saussure, indeed, tells us how we may see the vesicles for ourselves. If a cup of coffee, or of water tinctured with Indian ink be placed in the sun, minute vesicles of various thickness will be seen to ascend from the surface of the liquid. He adds that those vesicles which rise differ so much in appearance from those which fall, that it is impossible to doubt that the former are hollow. Kämtz, also, made measurements of the vesicles of fogs in Central Germany and in Switzerland; and in his valuable work on Meteorology, gives a table and a figure, showing the law according to which the dimensions of the vesicles vary in the course of the year.

(To be continued).

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XVIII.—THE FRAMEWORK OF THE DWELLING-HOUSE.

STRUCTURAL EXAMPLES (*continued*).

THE DISPOSAL OF HOUSEHOLD REFUSE.

THE "Patent Carbon Dust-Bin" of Dr. R. Nicholls, to which we referred last week, is constructed on the same principle as that adopted by the patentee for his "Patent Carbon Closet," so that a detailed description of the one will serve to convey an idea of the practical usefulness of the other. Both of these appliances depend upon the deodorising properties of carbon on decaying matters, and are so constructed as to bring the carbon to act thoroughly upon their contents; this is done by making use of the re-agent in a fine state of sub-division—*e.g.*, soot; and the following description of the dust-bin will explain the mechanism through which the intimate application of the carbon powder is brought about:—

Fig. 9 is a perspective representation of the apparatus, for the use of which we are indebted to Mr. Jonas, of Mortlake, sole agent to the patentee. It consists of a box, A, made of galvanised iron, and painted, if required, in any colour to harmonise with its immediate surroundings in tint, with a specially prepared varnish paint, which is said to be perfectly weather proof.

The dust and garbage are thrown into the bin through an aperture beneath the lid, B, which is made to fall back upon the top of the bin, A, when opened. The lid, B, is fitted with a carbon box perforated at the bottom, and must occasionally be filled with soot or powdered carbon. There is, in addition to this, a sliding tray, C, the base of which is perforated, and when shut home is provided with a circular aperture, which corresponds in size and position with the opening under the lid, B, so that it does not interfere with the operation of inception of dust and garbage; this tray is periodically filled with fine carbon or soot. Thus it is obvious that when the lid B is swung back so as to fall upon the top of the bin, A, it causes a shower of carbon dust to be discharged into the receptacle of the bin; the refuse is then thrown in, and the lid, B, closed over the orifice; this action causes a second shower of carbon particles, this time from both the tray and the lid, which entirely covers the fresh contents, and thoroughly deodorises them.

Fig. 9.

A sliding door D is made to work on flanges outside of the dust-bin, A, and, when the bin is to be emptied, is kept open by a latch which fastens on to a knob above. The door exposes the whole interior of the bin, so that every particle can be cleared out, whilst its arrangement of flanges on the outside of the bin prevents it from getting out of order. We have no hesitation in stating that the entire contrivance is not only ingenious; its especial value lies in the fact that it fulfils all the requirements of a thoroughly sanitary apparatus, and it therefore deserves a place in every well-appointed household.

A very important modification of the dust-bin is Dr. Nicholls's so-called "dust-pail." In practical details, the latter is a miniature of the former in all but shape and size. It has been devised to meet the wants of buildings which

Fig. 10.

are let out in "flats" or "floors," and may be kept with perfect safety within the rooms, or, if desired, in special extra-mural cupboards, or on the common landings. These

pails are provided with handles, and can be readily carried out of the house from time to time, as required, by the dustmen. Their prices are so low as to place them within the reach of all.

Dr. Nicholls's "Patent Carbon Closets," Fig. 10, act essentially in the same way as his dust-bins, and are in reality perfectly sanitary, because the re-agent is made to act so thoroughly upon the soil, and is physically of such a nature (a fine powder) as to get at every part of the closet contents. The only difficulty lies in the fact that the liquid waste keeps the contents in a more or less sloppy condition, and that, although perfectly innocuous, they have to be reduced to a suitable consistency with earth for removal. In some forms of his closet, however, even this objection is overcome; provision is made for drying the manure within, by means of artificial heat, immediately prior to its removal. By this process, the value of the manure is immeasurably increased, as it can be carted away in the form of a ready-made dry guano of the finest quality.

The first attempt made to overcome the nuisance from liquid waste was that of the Goux Company, in the development of the "pail-system." The "Goux-tub" consists of a tapering pail, widest at the top, 18 in. high, and 20 in. at its greatest diameter. The bottom of this tub is filled for a few inches with some light absorbent material, such as old straw from stables, shavings of wood or sawdust, spent tan or hops, flax-dressings, shoddy, or indeed, anything handy of the nature of the above. Upon this substratum, a mould of the same shape as the tub, but 6 in. less in internal diameter is placed, and the absorbent material mixed with a little powdered charcoal, soot, gypsum, or other deodorant, is stuffed into the space between the tub and the mould. Thus a lining of absorbing and deodorising powers is produced, and the tub is ready for use. It should be removed punctually once a week, thoroughly cleansed, and recharged in the same way. In actual practice the apparatus does not realise the great expectations which one would be led to form of its value at first sight; it does not act as an efficient absorbent, and when neglected, as such things are most liable to be, its use as a sanitary appliance is open to grave objections. This is one of the principal difficulties to be contended against in the working of the "pail," or even the "dry" system; they are both of them healthy and safe if carried out with care, and would be infinitely superior to the "hydraulic" system if they could but be applied with equal convenience, and with the same degree of facility. The "pail" system is to be condemned because of the excess of actual manual labour to which it gives rise, and because it is apt to become insanitary through neglect. Hitherto, the "dry" system has been found to be objectionable, for similar, though less marked reasons, but we hope to show in our subsequent remarks how all those objections have been recently removed, and how, in the face of neglect, and even abuse, the system can be profitably and universally employed. The "hydraulic" system is wasteful and insanitary; but it is wasteful in such a way as to enrich certain detachments of the community, and it is insanitary in such a way as only to prove baneful beneath a veil of expensive arrangements; add to this its extreme convenience for the disposal of waste products from our immediate presence, and the habit which the present generation have acquired through its extensive use, together with the total ignorance of the majority of those who employ it regarding sanitary matters, and it will follow, as a matter of course, that until some other system is brought forward, equally convenient and more sanitary, and unless the masses of the people are educated to recognise it as such, the hydraulic system will continue unabated.

METEORIC STONES.

By Jas. R. Gregory.

Among the great variety of natural-history objects offered for sale at the well-known auction-rooms of Messrs. Stevens, in King-street, Covent Garden, two or three Fridays ago, was a somewhat remarkable collection of objects from the outer world of space—viz., meteoric stones. Some eighty or more fragments of as many distinct falls of these extraordinary and rare celestial bodies, collected during the last forty years by the late Mr. William Terry, of Fulham, were offered for sale. Of late years, considerable interest has been taken in this subject, and much has been done with a view of showing the nature and origin of such objects; and, notwithstanding the researches in this country by Professor Maskelyne, as well as by Professor Daubrée, of Paris, Professor Tschermak, of Vienna, Professor Shepard, and the late Dr. Lawrence Smith, of the United States, and many others, little has been done to satisfactorily explain their origin. All we know is that they do fall from the heavens to our earth, and have been seen to fall on many occasions by very many trustworthy observers, but where they come from and how they are formed in nature is still a mystery. They are known to fall, accompanied by terrific explosions, in the daytime as well as at night, in fine weather as well as in stormy weather, and at all hours. Records of two to three hundred different falls during the last hundred years have been carefully kept, and these falls have been spread over the whole world. Previous to this are recorded a large number of falls in various parts of the universe at a very early period; but owing in most cases to imperfect data and observation, some allowance must be made in details, which are in some instances very meagre. Many are recorded in various parts of the United States, many in France, two recent well authenticated instances in England—in April, 1876, near Wellington, Shropshire, and the other in March, 1881, at Middlesbrough, Yorkshire—besides others in different parts of the world. A very large shower of these stones—several thousands—fell in Poland, in January, 1868. Still more recently another large shower at Mocs, in Transylvania, in February, 1882; and in February, 1883, a monster single stone fell with a thundering noise near Brescia, Italy. This stone weighed from 400 lb. to 500 lb. Examples of all these falls are now in the British Museum (South Kensington Natural History Museum).

These aërolitic bodies may be divided into two distinct varieties—the so-called "stony" group, and the iron, or metallic group. Much has been done by chemists who have analysed them, and it is found that the stony varieties consist of some twenty of the elementary substances such as are known to form the earth's crust. Not one new element has yet been found in these occasional visitors. The iron group seems to consist almost exclusively of metallic iron, associated with from 5 to 20 per cent. of nickel, generally with a small percentage of phosphorus and sulphur mixed with iron. The stony meteorites also usually contain nickeliferous iron, disseminated throughout the mass, which appears as metallic spots when polished. Recently, Dr. William Huggins, by the aid of the spectroscope, infers that there may be some affinity between comets and these bodies, their spectra being somewhat identical. Numerous workers and observers on the Continent, as well as in the United States and in our own country, are constantly recording new facts, and the magnificent collection in the British Museum, numbering over 350 distinct falls, tends to show the amount of zeal and energy of Professor Maskelyne, as well as of the present keeper,

Mr. Fletcher, in increasing this grand collection since about the year 1860. Mention may also be made of the great increase of specimens in the fine collection in Paris, under Prof. Daubrée, as well as that of Vienna, formerly under Professors Haidinger and Tschermak, and now under Dr. Brezina. These three collections are without doubt the finest and most valuable in the world. Many cities in Europe, as well as several of those in the United States, also possess remarkably fine and valuable collections.

Persons frequently ask the question, Are not people sometimes killed by these falls of meteorites? We can only answer, that there are instances recorded of persons being killed, among others by a large fall in Africa; it is noted by Chladni, one of the earliest of modern writers on this subject, that about the year 1020 many persons and animals were killed; and, again, in the year 1511, about five o'clock one evening, when a priest was struck and killed on the spot; still later, in 1650, a monk was killed by a meteoric stone; these seem to be all the instances recorded of loss of life.

Many persons not having a knowledge of these objects have an erroneous idea that the globular form of the marcasite variety of iron pyrites, which are extremely common in chalk districts, especially in the south of England, are meteorites, or aërolites—or thunderbolts as they term them. This mineral is of a brass yellow colour when fresh out of the chalk, but being very liable to decomposition, generally appears brown; but when broken, the brass-coloured radiating structure appears.

Any one interested in this subject of meteorites would do well to procure the printed catalogue of the British Museum collection of meteorites, which has a brief introduction to the subject. The Paris collection has also a valuable descriptive catalogue, and we believe that Vienna is also preparing one, also descriptive. These pamphlets would enlighten those who wish to know something trustworthy on the nature of these curious bodies.

THE INTER-OCEANIC SHIP RAILWAY.

(*Continued from p.* 198.)

THE pontoon, or floating-dock (see Figs. 2 to 6), is of the same general construction as those in use all over the world, save in some important modifications rendered necessary to fit it for its special work. For it is not enough that the vessel should be docked and lifted out of the water, but that it shall be caused to rest upon a cradle in such a manner that its weight shall be equalised fore and aft, and thus enable the carriage with its load to move easily and safely. This is effected by means of a system of hydraulic rams arranged along an intermediate deck about six feet below the upper deck of the pontoon (see Fig. 3). The arrangement of the rams is in both lateral and longitudinal lines, the former standing a little less than seven feet apart, the one from the other. The area of the combined rams in each lateral line is the same; the area of the one ram under the keel forward or aft is equal to the area of the five or seven rams amidships. They may be connected and made to work in unison, so that the same pressure per square inch of surface of the rams will exist throughout the whole system, or they may be disconnected by valves, so that a greater pressure may be brought upon the rams in a certain section or on a certain line.

It is no part of the duty of these rams to lift the vessel. They are designed only to resist its weight as it gradually emerges from the basin. They get their power from a powerful hydraulic pump placed on a tower affixed to the side of the pontoon, and rising and sinking with it, but of such a height that, even when the pontoon rests upon the bottom of the dock, it is not entirely submerged. The pontoon itself is directed by powerful guides, which cause it to descend and emerge from the water always in the same position.

A ship having entered the mouth of the Coatzacoalcos River, on the Atlantic side, and come up to the basin, the carriage with its cradle is run on to the floating dock; then water is let into the compartments of the pontoon, and dock and cradle gradually sink to the bottom. Then the ship is brought in from the exterior basin, and so adjusted as to position that her keel will be immediately over the continuous keel-block of the cradle, and her centre of gravity over the centre of the carriage. The water is then pumped out of the submerged pontoon in the manner employed in floating-dock systems, and it rises gradually, bringing the cradle up under the ship's hull (see Fig. 3). As soon as the keel-block of the cradle is close to the ship's keel, the hydraulic pump is called into action, and pushes up the pendent rods and posts of the supports gently against the vessel, closely following the lines of her hull and the run of the bilge. The pressure upon the rams increases as the vessel emerges from the water.

In the case of a ship weighing 5,000 tons, each of the fifty lines of rams would, of course, be called to sustain a burden of exactly 100 tons; and these lines being placed at equal distances the one from the other, it will readily be seen that each unit of the ship's weight is equally distributed. The weight and displacement of the vessel is learned from the pressure-gauge on the hydraulic pump.

The vessel being clear of the water, hand-wheels, or adjusting-nuts that move in threads cut in the columns of the supports, are run down to the bearings in the girder-plates, whereupon the valve is opened and the rams withdrawn, leaving the girders to support the weight of the ship. Now each girder has the same number of wheels, and, as described above, bears its just proportion of weight and no more; hence each of the multitude of wheels under the carriage is called upon to bear the same weight. This weight has been calculated to be only from eight to nine tons, though the wheels will be tested to twenty.

One of the many ingenious contrivances in the scheme is the "hydraulic governor," so called, and by which the unevenness of the plane of the pontoon, when it comes to the surface with its load, can be readily corrected. This apparatus is thus described:—"Two cylinders are attached to each corner of the dock, one being upright and the other inverted. Plungers attached to the pontoons move in them. These two cylinders are connected by pipes, and all spaces in the cylinders and pipes are filled solid with water. As the pontoon rises, the water forced out of one cylinder by the ascending plunger is forced into the inverted cylinder on the diagonal corner where the plunger is being withdrawn. Now, if there is, say, 100 tons preponderance on one end of the pontoon, one half this weight, or 50 tons pressure, will be exerted by each plunger on that end upon the water in its cylinder. This pressure is instantaneously transmitted through the pipes to the water in the top of the upright cylinder in the opposite diagonal corner, which acts with the same amount of pressure as a water-plunger upon the metal-plunger to hold it down; thus an equilibrium is maintained, and the pontoon compelled to rise and fall perfectly level. It is possible, by aid of a pressure-gauge attached to the pipes, to ascertain the exact amount of the excess of weight, so that, should this gauge show too great a preponderance, the pontoon must be lowered, and the ship placed in a new position."

The pontoon cannot elevate the rails on its deck above what would be a prolongation of the rails on shore, because of the heads of the anchor-bolts or guiding-rods, and these will also prevent any tipping of the pontoon when the ship-tracks each of 4 ft. 8½ in. Ships themselves are girders, and must of a necessity be so, from stem to stern, because in the tempestuous seas in which they are designed to roam, the one part is constantly being called upon to

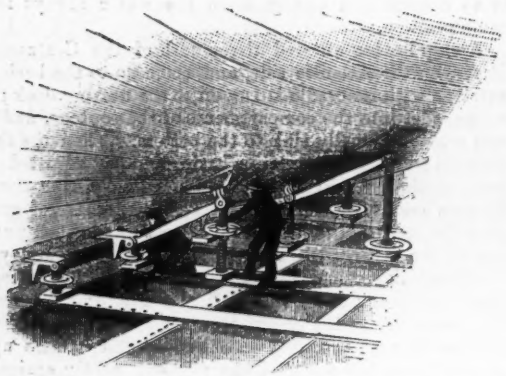

Fig. 2. Elevation of the Adjusting of the Screw Standard for supporting the vessel on the pontoon.

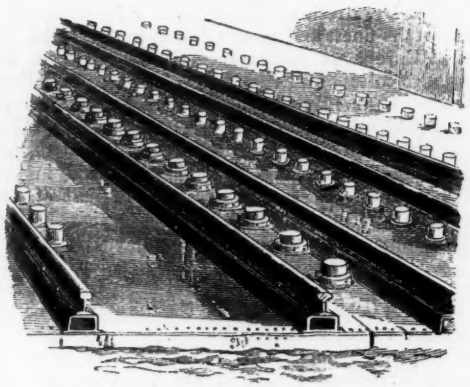

Fig. 4. Perspective view of Floating Pontoon, showing the number of hydraulic jacks used.

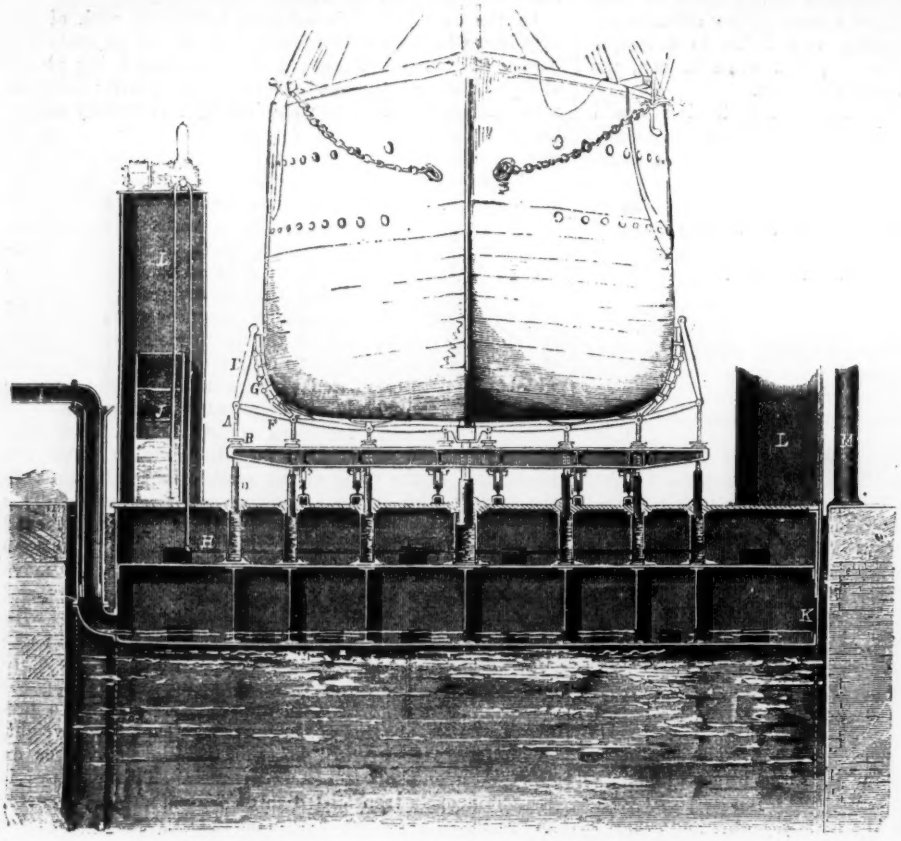

Fig. 3. Sectional Elevation of Pontoon and Railway Cradle.

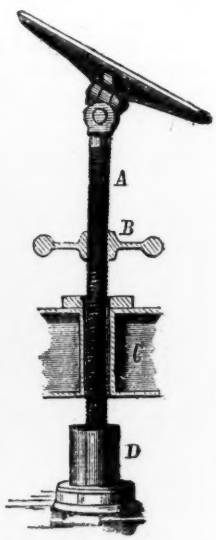

Fig. 5. Details of screw standards.

burdened cradle is moving off. The carriage with its cradle, which comes up upon the submerged deck, is calculated to hold a ship even more firmly than the launching-cradle used at the ship-yards, with its shores and stays. This carriage moves upon six rails, three standard gauge

support the other; now her bow projects over a great billow with nothing under to support it, and again she is poised upon a huge wave, leaving the midship section to support in a great measure both the bow and the stern; and were she not constructed as a girder fore and aft,

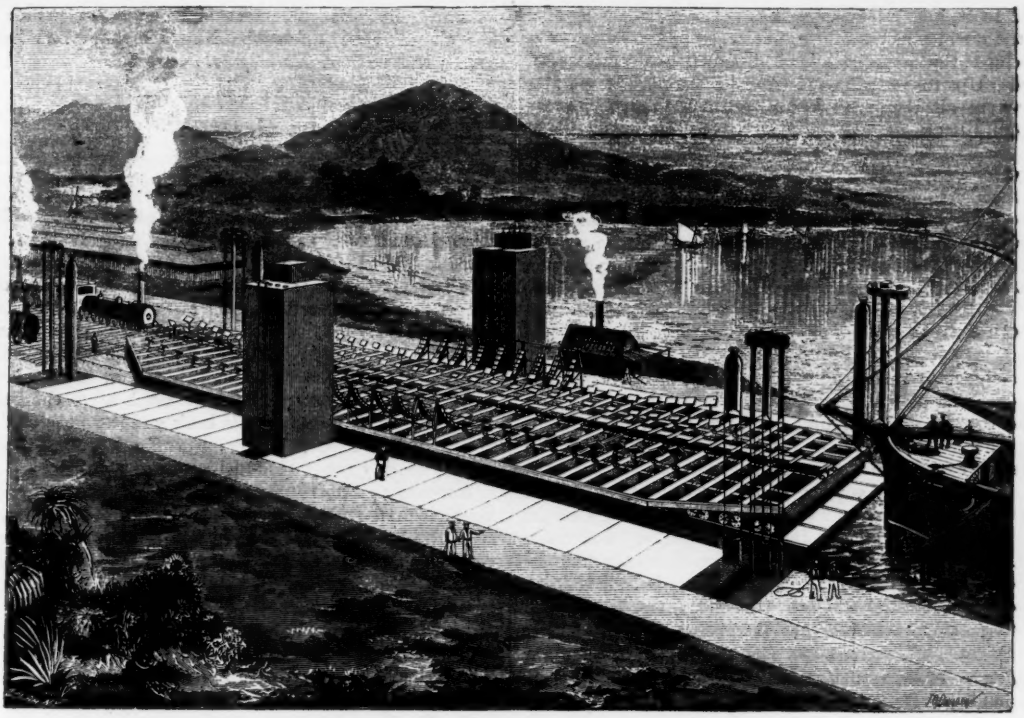

Fig. 6. The Lifting Pontoon and Railway Cradle.

her back would be broken in the first big seas she encountered. Comprehending this, the designers of the ship carriage make its strength reach its maximum in the cross girders, which are spaced like the lateral lines of the rams already described; that is to say, seven feet apart, and having sufficient depth and material in their plates to ensure an equal deposit of weight upon all the wheels. These latter are double flanged, and are placed close together, each being hung independently on its own journals, and having its own axle. Under an ordinary railway car the four or six-wheel trucks move together about a central pin. But in the ship carriage, which is not designed to move off from an almost straight line, this is not required, and greater strength is obtained by adhering to the rigid principle; elasticity being had by placing a powerful spring over each wheel. These springs will, as said before, bear a weight of twenty tons and have a vertical movement of about six inches, while the maximum weight they will be called upon to bear will not depress them more than three inches, and allow for crossing irregularities without bringing an undue weight upon the wheels.

There is also a system of supports for the vessel, each having adjustable surfaces hinged to the top of the supports by a toggle-joint in such a way that they may be made to closely follow every depression, and yield easily to every protuberance or bulging. They pierce the girders of the carriage, and are exactly pendent over the hydraulic rams when the carriage is on the pontoon and rests in its proper position. Thus, as will be seen, the ship, when crossing the Isthmus (see Fig. 1, *ante*), rests upon what might be called a cushion; and, indeed, she will have experienced far rougher treatment, both in the Atlantic and Pacific, under ordinary conditions of weather, than that had while *in transitu* by rail across the Isthmus.

(To be continued.)

Editorial Gossip.

For some reason best known to himself the compositor has entirely suppressed the η which I wrote before the words "Ursæ Majoris," in the third paragraph of "Editorial Gossip" on p. 200.

On the evening of this day 104 years; in other words, on that of March 13th, 1781, an eighth body was added to the solitary seven (including the sun and moon) of our system with which mankind had been acquainted from prehistoric times; for this is the anniversary of the discovery of Uranus by Sir William Herschel. Not that he was the first observer who detected the planet (which, as a matter of fact, at and about the time of opposition, is visible to the naked eye), inasmuch as it had been previously observed, and its position noted, once by Bradley, five times by Flamsteed, once by Meyer, and actually twelve times by Le Monnier, who would certainly have discovered its planetary nature had he only compared three of his own observations of 1765. It may serve, however, to give an idea of the care and method of the French astronomer if I recall the fact that Arago saw one of his observations of Uranus written on a paper-bag which had contained hair-powder! It is, further, instructive to note that had the great astronomer of Slough turned his telescope upon the planet on March 2nd, instead of on the 13th, he must have failed to detect its character from its motion, it having been at one of its stationary points in the heavens at the former date. Upon such trifles may great discoveries hinge. How Herschel himself named his addition to the solar system the Georgium Sidus, as a compliment to his patron, poor mad George the Third; how Lalande strenuously endeavoured to affix the name of Herschel

himself to it, an endeavour which survives in the symbol ♅ of the almanacks; and how, finally, by universal consent, it obtained the appellation of Uranus, are matters of history. Up to the date of its discovery, six planets proper were all that were known. Since then 246 more have been discovered.

Some one writes to the newspapers to say that he has heard the nightingale. White, in his "History of Selborne," speaks of its advent "in the neighbourhood of London," on April 12. What a pity that the gentleman who was so exceptionally favoured did not succeed in putting a pinch of salt on the tail of his unique specimen!

I fear that by my reference to the (alleged) "Faith" healing cases wrought by the Hanley "Salvation Army," on p. 176, I may seem to have conferred a factitious importance upon a very sorry piece of humbug indeed. In another column will be found a reprint (from our contemporary the *Medical Press and Circular*), of the report of a scientific expert on the asserted quasi-miraculous cures. From this it would appear that the grain of salt with which I took the original account of the healings might much more appropriately have been a bushel; and that, in fact, the entire exhibition is of a more distinctly mountebank character than I even imagined it to be. Bartlemy Fair and little Bethel are met together. The Clown and the Evangelist have kissed each other.

I have received a little pamphlet on "High-pressure Education," by Dr. Churchill, the surgeon to the Victoria Hospital for Children, from which, at a merely nominal cost, information and hints of a valuable character may be gathered by all concerned in the intellectual (and physical) training of the rising generation. Its author not only pleads earnestly for the wretched little victims of the Mundella craze in Board Schools, but also puts in a word for lads of a higher social grade, who, under the present detestable system of "cram," are loaded up to the muzzle like experimental guns, and (let off, as it were, in the examination, for which they have been stuffed with knowledge which they cannot assimilate) are left, after its discharge, as empty as drums. As Dr. Churchill attends weekly an average of over one hundred Board School children at the Victoria Hospital, he may, perhaps, advance at least as strong a claim to speak *ex cathedrâ*, as the doctrinaire gentlemen, who so gaily scatter the hardly-earned money of the metropolitan ratepayers in their palatial house on the Thames Embankment.

Among the most recent suggestions for the application of a scientific process to an economical use that I have come across, is one for checking the takings of tram-car conductors by photographs of the interior of the car taken at frequent intervals! The ingenious inventor of this adjunct to the observance of the Eighth Commandment does not tell us whether the occupants of the car are to be photographed consciously or unconsciously. At any rate, half-a-dozen people designedly or innocently fidgety might frustrate the whole scheme, and, by converting themselves into Cerberi (not to say Hydræ) upon the plate, slightly impair its value as a record of the persons present at any given instant. One thinks of the negro farm-servant, who, having been asked by his master if he had counted the pigs, rejoined, "Yes, massa, I count 'em all but one little black pig, and he jump about so dat I couldn't count 'im."

Probably no man in England is better entitled to speak *ex cathedrâ* on a purely horological subject than Sir Edmund Beckett. A most amusing letter, which every one should read, upon the New Time, appears from his pen in this month's *Horological Journal*.

Reviews.

SOME BOOKS ON OUR TABLE.

The Neanderthal Skull on Evolution. . . . .—By the Rev. Bourchier Wray Savile, M.A. (London: Longmans & Co. 1885).—Our first impulse was to treat this utterly nonsensical farrago seriously, and to point out the fitness of a writer to teach anybody, who quotes the dicta of Canning, Lord Beaconsfield, and Carlyle as authoritative in connection with the discussion of a question of pure science. Upon reflection, however, we feel that it will be more courteous and very much more charitable to Mr. Savile simply to close his book and say nothing further about it. The sooner such sorry stuff is forgotten the better for the literary reputation of its author.

Hot-water Engineering. How to Prevent Explosions. By F. Milan and J. Shaw. (Huddersfield: J. Broadbent & Co.)—Is simply a description of a patent mercurial indicator, designed to prevent kitchen boilers from blowing up.

Cruise of the "Alert" (1878–1882). By W. R. Coppinger, M.D., Staff-Surgeon, R.N. (London: W. Swan Sonnenschein, & Co. 1885.)—During the autumn of 1878 the Lords of the Admiralty despatched the *Alert* (already famous as the ship which had so far attained a higher northern latitude than any other) to survey various regions in the southern hemisphere, commencing in the Straits of Magellan; on the completion of her work there, to proceed to the north coast of Australia; surveying that, to go on to Singapore to refit, and return *viâ* the Cape of Good Hope; stopping en route at the Seychelles, Amirante Islands, and Mozambique; to fix astronomically the position of the Amirante group, and to take such soundings as they might be able on the east coast of Africa. The *Alert* sailed from Plymouth on this mission on Sept 25, 1878, and re-entered the Sound there on Sept. 3, 1882, after an absence of nearly four years. The story of this interval is told in the volume before us by Dr. Coppinger, who was surgeon and naturalist to the expedition, and who contrives in telling it to impart a very considerable amount of information indeed on natural history and ethnology, in a chatty, agreeable, and interesting manner. Truly, according to his account, the Fuegians must be in very proximate relation with "the missing link;" as it is not easy to conceive how any race or species much more degraded could legitimately be regarded as "human" at all. The student of prehistoric archæology will read with interest our author's account of the manner in which one of these savages manufactured a spear-head out of a broken pickle-bottle, in his presence. At Tahiti, whither the *Alert* proceeded after leaving Terra del Fuego, a singular contrast must have been presented by the graceful, half-Frenchified, and wholly immoral natives. The aborigines of Queensland seemingly occupy a mediate position. There is given, by the way, a curious plate of facsimiles of drawings by the native Australians. We have referred to Dr. Coppinger's description of two or three of the various races of men amongst whom he and his shipmates were thrown. It would be impossible to make a similar *précis* of his multifarious observations of every form of animated life. We trust that we have said enough to send the reader to the book itself for more, and, with the expression of this hope, will conclude our notice of it.

THE FACE OF THE SKY.

FROM MARCH 13 TO MARCH 27.

BY F.R.A.S.

DAILY examination of the Sun should be made, if the sky be clear, for spots and faculæ. The Zodiacal light may now be beautifully seen as a blunt luminous cone, with its axis roughly in the ecliptic, over that part of the horizon beneath which the Sun has set. The aspect of the Night Sky is shown in Map III. of "the Stars in their Seasons." Mercury is in superior conjunction with the Sun at seven o'clock this evening; and, of course, afterwards passes to the east of him, and becomes an Evening Star. Towards the end of the next fortnight he may possibly be caught by the naked eye over the western horizon soon after sunset. Venus is rather worse placed for the observer than she was a fortnight ago. Mars and Neptune are both invisible. Jupiter is, as we have said several times recently, the most brilliant object in the Night Sky. To-morrow night (the 14th) he will be just over Regulus ("the Stars in their Seasons," Map IV.), and the two objects will afford a curious spectacle to the naked eye. Numerous phenomena of his Satellites continue to reward the attentive watcher. Beginning with this evening (March 13), the ingress of Satellite III. occurs at 7h. 1m., and that of its shadow at 9h. 11m. The ingress of Satellite I. takes place at 9h. 45m., and its shadow follows it at 10h. 17m. Satellite III. passes off the planet's face at 10h. 39m.; Satellite I. at 12h. 5m.; its shadow at 12h. 37m.; while, finally, at 12h. 49m. the shadow of Satellite III. quits Jupiter's limb. This transit of the third Satellite should be carefully watched throughout for the reason so often given recently in these columns. On the 14th, Satellite I. is occulted at 6h. 53m. p.m.; to reappear from eclipse at 9h. 43m. 20s. On the 15th, the egress of the same Satellite happens in bright twilight at 6h. 31m.; its shadow follows it at 7h. 6m. On the 16th the transit of Satellite II. begins at 7h. 28m.; as does that of its shadow at 8h. 41m. The egress of the shadow of Satellite IV. occurs at 10h. 14m.; Satellite II. passes off at 10h. 24m., and its shadow at 11h. 36m. Perhaps Satellite II. may be seen to reappear from eclipse at 6h. 40m. 36s. on the 18th; but the bright twilight renders this doubtful. On the 20th, the ingress of Satellite III. begins at 10h. 24m.; it is followed by Satellite I. at 11h. 31m.; as that is, in turn, by its shadow, 12 minutes after midnight. On the 21st, Satellite I. will be occulted at 8h. 38m. p.m., and reappear from eclipse at 11h. 37m. 45s. On the 22nd, the ingress of the shadow of this satellite may possibly be seen at 6h. 41m. The satellite leaves the face of the planet at 8h. 17m., and its shadow at 9 o'clock. On the 23rd, the transit of Satellite II. commences at 9h. 46m., and that of its shadow at 11h. 16m.; the satellite passes off 41 minutes after midnight. On the 24th, Satellite III. reappears (in strong twilight) from eclipse at 6h. 43m. 26s. p.m., and Satellite IV. is occulted at 8h. 49m. Lastly, on the 25th, Satellite II. will reappear from eclipse at 9h. 16m. 56s. p.m. Saturn gets nearer and nearer to the west, and souths now in bright sunlight. Hence, he must be looked at at the moment it is dark enough. His position in the sky differs but little from that described on p. 174. Uranus continues to travel in a north-westerly direction from η Virginis. The remarks we made a fortnight ago (same page) are still applicable. The Moon will be new at 5h. 36m. 9s. in the afternoon of the 16th, and enter her first quarter at 5h. 23m. 1s. on that of the 23rd. No less than ten occultations will occur before midnight during the next fourteen days. On the 18th B.A.C. 481, a star of the 6½ mag. will disappear at 6h. 58m. p.m., at an angle of 153° from the Moon's vertex; reappearing at 7h. 54m. at an angle from her vertex of 314°. On the 21st B. A. C. 1351, also a 6½ mag. star disappears at 6h. 30m. at a vertical angle of 193°; to reappear at 6h. 58m., at an angle from the vertex of 242°; on the same night, 75 Tauri, of the 6th mag. disappears at 8h. 37m., at an angle of 111° from the vertex of the Moon; and reappears at 9h. 34m. at a vertical angle of 336°. On the 21st, an occultation of Aldebaran (α Tauri) will happen, which should be most carefully observed for the reason given on p. 136. The disappearance will take place at 11h. 43m., at an angle of 128° from the lunar vertex. The Moon will have set before the star reappears. On the 22nd, 111 Tauri, a star of the 5½th mag. disappears at 6h. 52m. p.m., at an angle of 84° from the vertex of the Moon. It reappears at 7h. 54m., at an angle from her vertex of 334°. 117 Tauri, of the 6th mag., will, later on, at 9h. 2m. p.m., disappear at a vertical angle of 56°; reappearing at an angle of 19° from the vertex at 9h. 23m. On the 24th, 68 Geminorum, a star of the 5½th mag., disappears at 11h. 39m. p.m., at an angle of 122° from the Moon's vertex, to reappear 37 minutes after midnight at a vertical angle of 294°. On the 25th B.A.C. 2872, a 6th mag. star will disappear at 12h. 41m. p.m. at a vertical angle of 113°, reappearing at 1h. 38m. a.m. on the 26th, 295° from the lunar vertex. Lastly, on the 27th B.A.C. 3529, of the 6th mag. disappears at 10h. 24m. at an angle of 37° from the vertex of the Moon; and reappears at 11h. 23m. at an angle of 303° from that vertex. Later, 43 Leonis, another 6th mag. star, disappears at 11h. 37m. at a vertical angle of 131°, reappearing 28 minutes after midnight at an angle of 233° from the lunar vertex. In every one of these cases the disappearance happens at the dark limb of the Moon, and the reappearance at her bright limb. The Moon is in Aquarius when our notes commence, and is travelling through that constellation until 1 a.m. on the 16th, when she enters Pisces. It takes her until 2 a.m. on the 19th to cross Pisces into Aries, in which she remains until 5h. 30m. p.m. on the 20th, at which hour she enters Taurus. In her passage through this last-named constellation she arrives at 6 a.m. on the 23rd on the confines of the narrow northern strip of Orion, crossing which she, 11 hours later, emerges in Gemini. At 7h. 30m. a.m. on the 25th she quits Gemini for Cancer, out of which she moves at 9 p.m. on the 26th into Leo. She is in Leo until 2 a.m. on the 28th, when she descends into Sextans.

THE "FAITH-HEALING" CASES.

(From the *Medical Press and Circular*.)

"WE dislike such nonsensical gossip as is not supported by symptoms, but only by faith," is the opinion expressed by Paracelsus 300 years ago, and it is no less true now in reference to the so-called "Faith-healing" of the Salvation Army.

Some very good accounts of this extraordinary work have appeared in the daily press, with no lack of critical inquiry concerning them. But, notwithstanding this, to most persons the evidence is very unsatisfactory, and it is difficult to sift what may be real from what is clearly false. With a view to forming a definite opinion concerning the reported cases, I have made inquiry into a fair number of them, and have taken the opportunity of attending one of the "Faith-healing" services of the Hanley Salvation Army. My experiences may interest others, and the inferences drawn from them may perhaps convince some sceptics that so far as supernatural cures are concerned, the thing is a delusion.

It seems to me unnecessary to enter into the general question of faith in the cure of disease. Every medical man is familiar enough with the influence which the mind can, especially under certain states of excitement, exert over the body. We meet with such instances daily, and the physician is ready enough, as a rule, to acknowledge and avail himself of them. We are not unfrequently told that our visits to our patients do more good than the medicine we prescribe—and truly enough. We are now asked to believe that the power to work miracles has been given to certain men and women, notably some of the "officers" of the Salvation Army, in a manner, to say the least of it, repugnant to one's common sense.

Let me first describe what I saw and heard. A large circus, crowded in every part with a very orderly and well-behaved audience, the arena containing a number of lame, deaf, infirm, or sick persons come to be healed, whose faces bore evident signs of sincerity in their belief. Some had crutches, some sticks, some were brought in bath-chairs, some were children in arms. After singing, prayers, and so on, one respectable man was requested to state what he had witnessed in the afternoon. This was to the effect that a man who said he had been deaf for forty-eight years was cured. As usual, there was no evidence forthcoming that the man was deaf, and he was not there to be examined. Another, a merchant, as he informed us, had seen a boy at Manchester who was both deaf and dumb, who, after the healing process, was able to hear and speak. But this, again, had to be accepted on faith, as the boy was not present. This gentleman told us an extraordinary story of how a child of his own was once at the point of death from bronchitis, and, after the doctor considered the case hopeless, he and his friends prayed for the child, but still without any result, when a lady arrived on the scene who recommended champagne to be given, and from that time the child recovered! This is a fair specimen of the sort of logic introduced into the discussion of this matter. What connection it had with "Major" Pearson's assumed powers I entirely fail to appreciate. Next came the man concerning whom some letters appeared in the *Standard*. He is there stated by the Mayor of Newcastle to have "been suffering for some time from acute rheumatism, and scarcely able to get off a chair." The man himself stated that he had bronchitis most winters, more or less, and in summer had rheumatism also. He had been to Buxton in September, had not been out of his house for two months. He said he could have gone with his stick, but was afraid. He believed he would be healed; he went to the meeting, lost his fear, and, no

doubt, very much to his astonishment, found he could walk after all. There seems to have been nothing to prevent his doing so before, except his want of confidence in himself.

Then came a speech from the Major, which consisted chiefly of a warm diatribe against sceptics, doctors, infidels, and *hoc genus omne*, in language strong enough to drive out any evil spirits there might have been lurking in the midst of us. Following this we heard from the father of a boy who was present how he had been "cured" of epileptic fits a fortnight ago. He described the result amid loud excitement and ejaculations from the audience, and then very naïvely added that "the boy had been sometimes two months, and once as long as three months without an attack!" But the sequel forms the best commentary on this case, which, by the way, is loudly proclaimed as one of the perfect cures. The boy was shortly after the "healing" bitten by his father's pony, but then taken, not to the "Major," but to his own medical man. Surely a man through whose instrumentality epilepsy could be exorcised could heal a simple wound! Well, after this had lasted about two hours the real business began. A young man stepped forward who said he had "heart disease." He knelt at a table with about eight or ten of the officials, a number of whom, women mostly, placed their hands on his head. The "Major" crossed his forehead with oil, and after speaking very earnestly to him for a time, asked him if he did not feel healed. He replied in the negative. The same process was repeated, some of them shouting to him that he was healed; but still he said nay, and was ignominiously dismissed with the observation from the Major, "You don't understand faith."

Next came a deaf old man, but who could hear evidently if spoken to in a loud voice. The same process was repeated amid a very babel of noise, praying aloud, ejaculations of all sorts, earnest entreaties shouted to the patient to hear, and at last it was announced, "The Lord be praised, he can hear," and he was told to express his thanks. Unfortunately, however, for the success of experiment, it required much louder speaking on the part of the Major before he could hear what they meant. It was perfectly clear the man was not a whit the better.

Then a young man who, when asked in an ordinary tone of voice what was the matter, informed us he was deaf. He was said to have come from the South of England, and gave an address, which he afterwards said was not his address, and as a matter of fact his real address was not ascertained. Before the hands had been on his head more than about a minute, he jumped up, excitedly exclaiming he could hear, when a perfect tumult ensued. But on examining him afterwards we found he was quite deaf in one ear, and only slightly deaf in the other, as he was before. This was stated to be a cure. I failed to see it, for I had observed him all the evening joining in every hymn, and evidently hearing what was going on.

The next and last case taken was another of deafness in a girl, whose mother stated she was very deaf. I noticed, however, that when one of the officials went to her, and asked her what was the matter, "Are you deaf?" "Yes, I am deaf," she replied, which, of course, would not have been her answer unless she had heard the question. This, after a time, was proclaimed to be a case of "healed," but the Major could not get any reply from her until the mother spoke, whose voice she knew and replied to. There was no difference whatever as far as I could make out.

After this case, others requiring more privacy were taken into the vestry; but I was informed that those I saw were fair specimens of what had been accomplished before.

It is, of course, simply ridiculous to call any of these cured. With regard to some of those which have been published in the daily journals, I have made inquiry into some of them classed as "healed," and, as far as I have gone, am unable to find one which will bear the interpretation which has been put upon them.

One woman, a patient of my own, who was said to be cured of deafness, and so proclaimed at one of the meetings, tells me that "it is all nonsense," she "cannot hear a bit better." Yet she is a woman full of faith in the power to heal. Her son, who has paralysis, they would not attempt to cure.

The same person tells me that near her was sitting a girl who was blind. She underwent the healing process, and the "Major" announced to the audience she was restored to sight, which was, as usual, followed by loud exclamations of thanksgiving and exultation. But when he put his watch before the child and asked her what she could see, she said: "Mammy, what is it? I can't see anything." This was, of course, drowned in the general hubbub, but my informant vouches for its accuracy.

A case made much of is that of a manager at a manufactory, who was taken in a bath-chair to one of the meetings, suffering from paralysis, and who was said to have been so far cured as to be able to walk. But he has been to each meeting since, still in his chair, in which he remains the whole time.

I could go on multiplying these cases, but those I have given speak for the rest. One other, however, I ought to mention, as it is that which excited so much attention at the first. It is that of a young woman who was taken in a chair, said to be suffering from paralysis for two years, and unable to move herself. She is one of those who may be said to have been cured, and a good type of what might be expected. The medical man who attended her and the nurse both state that it was a case of simple hysterical hemiplegia, and the nurse had frequently told her that she could walk well enough if she would only try. That, however, was just what she would not do until, under the influence of the excitement and the physical force used to drag her out of the chair at the meeting, her will at last was made to overpower her emotional state, and she walked. But to say she was cured would seem a false assumption, inasmuch as there was no physical disease to cure. Any other shock of a mental character would probably have effected a similar cure.

This is, indeed, the whole secret of what little success these people can lay claim to. They are generally sufficiently wide-awake to decline to undertake any real physical affection, such as a club-foot; and yet, even with the selection of cases they make, the only impression I have been able to learn as having been made on any is of a purely mental or emotional character.

My own conviction is that in this nineteenth century, a morbid excitement of this kind will be very short-lived, and certainly, for the sake of those whose minds are incapable of resisting such ecstatic influences, it is devoutly to be hoped it may prove so.

Miscellanea.

We understand that Dr. Zerffi will to-morrow afternoon (the 14th), at 3.30, commence a course of thirty lectures in the Theatre of the Royal School of Mines, on "The Historical Genesis and Evolution of Humanity," to be continued on succeeding Saturdays until the completion of the series. They are delivered under the auspices of the Society for the Promotion of the Study of General History.

On the first of this month that excellent little Belgian astronomical serial, *Ciel et Terre*, entered on the sixth year of its existence. For the future the editorial staff will be exclusively occupied with the scientific conduct of the journal, the merely business details being henceforth transferred to the National Institute of Geography. The editors express a hope (in which their English confrères will heartily join) that the public will aid them by their support in their work of popularising science.

Harleian Society.—The Council have just issued to the members the first volume of the "Christenings at St. James's, Clerkenwell, from 1551 to 1700," and the continuation up to 1754 will form Vol. II., and is nearly all in the press. The "Visitations of Bedfordshire" in 1566, 1582, and 1634, are now being issued to members, and that of "Dorsetshire," in 1623, is also nearly completed. It is proposed to print the Weddings which have taken place at St. George's, Hanover-square, from the commencement of the registers, and G. Leveson Gower, Esq., F.S.A., will edit the volume. The registers of Christ Church, Newgate-street, are transcribed, and will shortly be put in the press.

The number of gas-lighted buoys in use is rapidly increasing. Two have just been sent out to Canada for use on the St. Lawrence, and three more have lately been added to the nine already in use on the Clyde. The Garmoyle lightship, also on Pintsch's system, is in course of being altered from an oil lightship with a crew to a gas lightship without one, the light being of six weeks' duration. Plans are, moreover, being prepared for placing a gas light on the Gantoch rocks, while the small gasworks on Pintsch's system, put up for the Trinity House at the South Foreland, are reported to have proved a great success, and to form a special feature in the lighthouse experiments there.

Ivory rules and scales may be cleaned well by scrubbing with a new soft tooth-brush, soap, and tepid water; then dry the ivory and the brush, dip the latter in alcohol, and polish the ivory until it has regained its former polish. If the water has given the ivory a yellowish tint, dry in a heated place. If the ivory has grown yellow with age or careless handling, it can be bleached by placing it under a glass bell, with some chloride of lime and muriatic acid in a small vessel, and setting the whole thing in the sunshine. Care must be taken not to inhale the fumes of the acid as it works on the lime. The bleaching properties of the chlorine destroy the yellow colouring matter in the surface of the ivory, and it resumes its original white tint.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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EGOISM, THEISM, AND COSMISM.

(L'UNIVERSE C'EST MOI.)

[1629]—In an instructive article of KNOWLEDGE (Feb. 20), entitled "Plant and Planet Life," is an impressive sentence to the effect "that hatred to the development theory, as applied to solar systems and stellar galaxies, is an effort to avoid recognising the nothingness of man in presence of the infinities of time, space, and vitality within the universe of God." Now, one of the objects of the brain theory of the world is to traverse this postulate of the overwhelming sense of human insignificance in view of the "immensities" and "eternities" with which Mr. Carlyle has so familiarised us, by their resolution into creations, percepts and concepts of the architectonic Ego itself. I have been propagating this *volte face* for a number of years past, though finding it even more unwelcome to the slow-moving British intellect than the doctrine of Descent itself.

In a recent number of this serial there appeared, by the liberality of the editor, a short sketch [1602] of the Brain Theory, or Hylo-Idealism, with the title "Hylo-Phenomenology and Ontology." My position, when rightly envisaged in true perspective, must appear an irrefragable truism. The world we see and cognise *must* be an object of sense and thought, a sensible world-sensibility being clearly a function of vesiculo-neurine. It must be, therefore, an immanent or esoteric world, not a transcendent or exoteric one. Light, "creation's mind," which renders all things in the heavens and earth visible, is itself non-luminous till kindled into luminosity in, and by, what Mr. Cave Thomas graphically labels the only colour-box, viz., the sentient eye. So that, in reality, we never can escape from self, or expatiate in God's, or any other, universe except in that fashioned by our own consciousness. And consciousness, being seated in the supreme ganglia or cortex of the encephalon, each individual sentient being and sum-total of individuals that constitutes humanity, when its nature is traced to first principles, has the right to cap Louis XIV.'s vaunt, "L'état c'est moi," by the quite sober and sane scientific formula of the motto at the top of this synopsis. Surely all must see, from a bird's-eye view of this question, the *inevitability* of the induction, which, however, by no means infers *Acosmism*, but merely posits identity of macrocosm and microcosm, in the latter of which alone resides, as *vis insita*, every mode of sentience. To me, at least, this plain, common-sense, common-place, synthesis seems quite to explain the *megalomania* of religious mystagogues, as well as the confusion of brain-force and its objects, conditioning such grandiose delusions as those of the astronomer in Rasselas.* Ideally, or phenomenally, which is our highest reality, the lowest sentient being *does* create its own world, which in the human being includes all the above-named solar systems and stellar galaxies, which thus form the glory, not the shame, of their Creator. In no two brains can the universe—abstract or concrete, though similar from structural similarity—possibly be identical. *Quot cerebri tot mundi* is a pendant to *Quot homines tot sententiæ*. So that each of us must claim, without presumption, and as our inalienable birthright, to pose as the Platonic *Logos*, an adequate definition of which we find in the first verses of the 4th Gospel. Beyond this, *Self*-contemplation and inspection, which is, according to Max Müller, the attitude of the God Brahm, and, according to the late lamented Sir A. Grant, that of the Aristotelian Nous, Humanity can self-evidently penetrate. It corresponds with the Protagorean formula, "*Man or mind the measure of all things*," merging Theism in Theanthropism, thus levelling up Egoity to our past and present accepted ideal of Deity. All perception and conception is clearly the contents of the former, not of the latter, a position which recent advances in all departments of physical research, from astronomy to anatomy, have completely rescued from the old cloudland of mysticism and metaphysics. Science itself is at fault in its opposition to anthropism, of which Nature's "bright image" is but an impersonation. Just as Lord Bacon was in blaming naturalists for spinning, as spiders' cobwebs, systems out of their own *viscera*. Man, by the law of his organisation, cannot, in great things or small, act otherwise. Such autopsical procedure is his "categoric imperative." His brain is but a *viscus*, and out of it proceed all "things," living or, so-called, dead, in a world all phenomenal and relative. That *officina rerum* is, in a still wider sense than Eve, the universal matriarch, apart from which, as essential to consciousness, all is nothingness and blank oblivion.

ROBERT LEWINS, M.D.

* As a matter of fact, all poetic inspiration *temporarily* subjects its votary to this pseudo-*ecstasis*. Lord Tennyson precises it in a couplet of his "Palace of Art":—

"Lord over Nature, Lord of the visible earth [worlds],
Lord of the senses five."

HYLO-IDEALISM.

[1630]—So far as I understand Mr. Cave Thomas, he holds that the world, as known to us, falls into three divisions:—1st, "objects," which appear to consist chiefly of "vibrations;" 2nd, the human nervous system, or what he oddly styles "subjective nerves;" and 3rd, the human consciousness, including the phenomena of light, sound, &c. Dr. Lewins unifies the three divisions, and asserts that nothing outside consciousness can possibly be an object of knowledge. The latter axiom may seem incompatible with the thesis that consciousness is a function of the cerebral cortex; but the incompatibility is merely apparent, as I have tried to show in an article published last December in the *Journal of Science*. It is quite true that we can only *infer* the existence of matter; but the inference is deducible from an assumption which lies at the basis of all reasoning whatsoever. If reasoning, or intellectual activity, be possible, the Ego cannot be a mere bundle of passive pictures, or mental phenomena, but must be an acting Entity. And since (in the words of Prof. Huxley) "those states of consciousness which we call sensation are the immediate consequent of a change in the brain excited by the sensory nerves," we are led to the conclusion that the cerebral cortex is the "fons et origo" of thought and emotion, and is therefore identical with the Ego. There is obviously no excuse for the further assumption of "an essence superior to, and dominating matter"; therefore, having no evidence in favour of Dualism, we obey the law of parsimony, and rest in Monism. Beyond the bare attributes of existence and activity, we do not pretend to know anything of matter. So far as "inferred" it is *within* the mind; beyond our power of inference, it becomes to us null and void. Neither the attraction of gravity nor anything else can be "explained" by Newton or by any other philosopher; and we gain nothing by styling the forces of Nature "Animistic."

Berkeley's special contribution to mental science is the axiom that a sensation cannot possibly resemble anything which is not a sensation. I must refer Mr. Cave Thomas, not to Lewes's article, so considerately indicated by the editor, but to Berkeley's own writings, and to the divisions of Kant's "Critique of Pure Reason," entitled, "Transcendental Æsthetic" and "Transcendental Analytic." And since the necessity of compression has, doubtless, rendered this letter somewhat obscure, permit me to mention the following tractates:—"The Identity of Vital and Cosmical Force," "Life and Mind, on the Basis of Modern Medicine," both by Robert Lewins, M.D., and "What is Religion," by C. N., published by Messrs. Stewart & Co., 41, Farringdon-street, E.C.; also the following articles, by C.N., printed in the *Journal of Science*: "Animal Automatism," April, 1882; "The Philosophy of Thomas Carlyle," June, 1882; "The Brain Theory of Mind and Matter," March, 1883; and "Hylo-Idealism—a Defence," December, 1884.

C. N.

THE FALLACY OF MATERIALISM.

[1631]—Referring to Mr. W. Cave Thomas's letter (1613), is there not sense in the following objection to Bishop Berkeley's system? A being, such as an oyster, with no means of ascertaining the opinions and impressions of other beings, might plausibly conceive that all his own are untrustworthy, and that his idea of an objective universe may be but an idea. It cannot, however, see that higher animals would be justified in so concluding (if they could think so far), because they can see that all others are agreed on the

predicates of many phenomena—food, pain, danger, &c. With us the case is, of course, very much stronger. Each of us takes such a distinct, individual view of certain things (not mere opinions or tastes, but impressions as to what phenomena really are before us), as to have originated the proverb, "Quot homines, tot sententiæ." Yet, in spite of this almost infinite divergency, we have the identical testimony of billions upon billions of men that certain facts are presented to the senses of all in the same way. Now, what antecedent probability is there that each Ego should conceive the properties of matter exactly the same as all the others, unless those properties are real? Is it not so improbable as to be untenable to suppose that the whole race, differing on so many subjects of thought and belief, should yet be at one as to certain common phenomena, unless those phenomena are the manifestation of objective existence?

Hallyards.

THE NEW CHROMATICS.

[1632]—The theory of light would, I have reason to believe, be considerably advanced by a more careful and wider study of the phenomena classed as the *ocular spectra*. It ought to be more generally known that the true science of the harmony of colours is based on the study of these phenomena, and also that everyone carries about with him the necessary appliances for experimenting with them—namely, eyes. But, as excessive use of the eyes for that purpose is injurious, it would be well if a great number of investigators would each experiment a little, and so divide the labour. The ocular spectra supervening on sun-daze are not only very interesting when examined, but present peculiar features that still stand in need of explanation; for instance, any one of the sequent *spectra* changes colour if its field be changed from light to dark, or *vice versâ*. A red spectrum in a light field becomes a vivid green in a dark. So that the same impression, the same image, alternately appears of the contrasting, or complementary colour. And if the initial impression be sufficiently strong, the experiment may be several times repeated with the same spectrum. This fact, moreover, appears to me to furnish conclusive evidence that Dr. Young's three nerve hypothesis is erroneous. W. Cave Thomas.

MEANTIME SUNDIALS.

[1633]—In the *English Mechanic* for Aug. 19, 1870, Vol. XI., page 523, col. 2nd, at the end of a reply to query 4131, occurs the following passage:—"It is not generally known that dials (and those of elegant forms) may easily be made to show clock-time, exact to a quarter minute, throughout the year, and even to a second (except in a few days at midwinter, and fewer at midsummer), by having two gnomons, used alternately for nearly half-a-year each. I propose this problem to the ingenuity of some of your readers.—E. L. G."

I am not aware that any of the readers so appealed to sent a satisfactory solution of the problem, and the name of the proposer of it has since ceased to appear as a signature in the correspondence columns of the *E. M.* As, however, I see that he sends interesting letters to Knowledge, I venture to take this means of asking him if any description of these sun-dials has been published, and if so, where, and if not, to suggest to him the desirability of either publishing the details of their construction, or of causing them to be made for sale, which I am not aware that they have been.

My own solution of the problem would be as follows, but from from what "E. L. G." says on pp. 597 and 598 of the same volume, and I think elsewhere in the *E. M.*, I infer that it is not his solution. Let marks indicating hours and their subdivisions be made on the inner surface of a part of a ring extending no farther than is needed to contain the sunlight hours of the longest day, the hour marks being fifteen degrees apart, or at the rate of twenty-four hours to the circumference. Let this be fixed with its axis parallel to that of the earth, and let the gnomon be a solid of revolution, the generating curve of which is such that, when the gnomon is suitably placed with its axis coincident with that of the other part of the dial, one side of it shall *just* hide the sun from the 12 o'clock mark at mean noon during the period from one solstice to another, when it is to be exchanged for the other gnomon, which must be so shaped on the same principles as to act in the same way during the other half-year. The objection to this plan, in my mind, is that there would be a risk of reading off the position of the shadow of the *wrong side* of the gnomon, and so making a mistake as to the time, and I do not see any way of obviating this without diminishing the number of hours during which the dial would be available. A suitable screen, extending from the gnomon to either the mark at six or that at eighteen, would cure this defect, but would also preclude the dial from being used in summer for more than about twelve hours of the day, unless, indeed, the gnomon were made very thick, and would detract from the elegance of which "E. L. G." speaks. The graduations must not consist of lines, as in the common sundial, but points, which could be indicated by the intersections of a line running through them all with short cross lines having suitable numbers at their ends to indicate the hours. If the ends of the graduated arc are sufficiently thin in the direction of its axis, there will only be a very few days at the equinoxes during which their shadows will interfere with that of the gnomon. D. L. X.

A CURIOUS LUNAR PHENOMENON.

[1634]—Observing the moon on the 19th ult., with a 3½-in. refractor, I noticed that the small crater inside Hercules, instead of being filled with black shadow, shone with a dull, deep-red colour. The power I was using was 100. I changed it for 180, and again for 250, without any alteration in the peculiar appearance of the crater; and I also compared, or rather contrasted, the shade of the crater with every shade I could find, which ordinarily it would have resembled, especially that of every crater, similar in size, shape, and position. The time was between seven and eight p.m., and the crater near the morning terminator.

The hue was quite obvious, and seemed to catch the eye immediately, even in a large field.

I turned the telescope to the same spot on the next evening (20th ult.), but could perceive no abnormal appearance.

I shall be glad to hear if any other of your readers have noticed this phenomenon, and if any explanation can be offered.

William Gray, Jun.

LUNAR GLOW.

[1635]—Whilst visiting some friends at Blairmore, Loch Long, Argyleshire, on Saturday, 28th ult., I observed rather a curious lunar phenomenon. While the moon rose above the hills opposite Blairmore, and appeared in full view, the sky below, and spread for a considerable distance, had a sort of dim red or rose-colour appearance, something like the after-glows that appeared so frequently autumn before last. I observed this about 7.15 o'clock, and it lasted till near 10 o'clock, appearing very bright between 8 and 9 o'clock. Can you explain this curious phenomenon, or has any of your other readers observed this. I had another friend walking with me at the time, and pointed this out to him.

John A. Stewart.

[Records exist of the observation of this phenomenon during the last two years; but, at this moment, I am unable to lay my hand upon any of them.]—Ed.

THE PHILOSOPHY OF ARGUMENT.

[1636]—As a constant reader of your journal, would you allow me space for a few remarks on this subject, which, I think, comes within the scope of the principles you advocate, and which are suggested by one or two remarks which have appeared lately in the letters of correspondents and in other paragraphs of Knowledge.

There is nothing more delightful than the thought that all knowledge can be brought into the calm light of a true philosophy, and there weighed and tested, approved or rejected, as truth permits. This is not only a delightful, but a true theory. But, alas! like a good many good theories in this world of ours, it but too often breaks down in practice. Nevertheless, it may be worth while to endeavour to make out how and where it breaks down, and why; to see whether it is altogether impossible to reduce to first principles, and to systematise the way in which this theory breaks down.

To plunge at once *in medias res*, and to illustrate this matter by an example, I make an assertion. You meet that assertion, not by a counter *ego dico*, nor by a refutation of my facts, or logical deduction from them, but by the counter assertion that I am but advancing as arguments deductions from my own sensations or my own peculiar views of life.

Let us take this as an example of philosophic argument which sometimes is pursued, and see whether there is not something in it which is worth devoting a little attention to.

A priori every man's opinion is of as much account as every other man's, but, when he has shown himself to be unworthy of credit by *self-refutation*, his opinion ceases to be of value. But the question I should like to raise is this, In what other way can he render himself from a *philosophical* point of view unworthy of credit, *except* by self-refutation?

The reply to this may be, "When he controverts doctrines which by a consensus of opinion of philosophers ought to be maintained." But this is not philosophy. As a matter of fact, there is no such consensus of opinion. And the reply, to be put in a philosophic form, should be this, "When he controverts doctrines which, in my

opinion, philosophers should be considered to have a consensus of opinion upon." But what is this but, in fact, meeting an argument as fallacious because it is peculiar to the man who advances it by an argument as admissible because it is advanced by myself.

I may, however, be wrong in my own assertion that there is no consensus of philosophic opinion. And this is where I desire to be set right if I am wrong. There certainly ought to be a consensus of opinion somewhere. If there is, where is it? What ground does it cover? On what principles, and how far, does it go?

But if I am right, that there is no consensus of opinion, can this striking fact be made the subject of philosophic consideration?

Generally, what hinders discussion is irritation; and irritation and anger start up from a great many sides and from a great many reasons. Directly people's own pet theories are controverted, a natural resentment takes possession of them, and when this is the case, in however small a degree, there is no hope, or little hope, of a satisfactory conclusion being come to from any argument they may embark in.

The question, then, is how to arrive at that perfect equanimity of temperament in which the mind is prepared to accept as truth that which to the mind, for the time being, is shown to be truth. If a man is absolutely willing to accept truth, and at all costs to act upon it, then he must be admitted to be in that serene, philosophic state of mind in which it would be most satisfactory to maintain an argument with him.

But, I would ask, can it be shown what that state of mind must be? Can it be demonstrated so as to be beyond all manner of doubt? I think it can. But as this my opinion goes for as little as, and perhaps less than, any other man's opinion, I should not like to state what it is before I hear what others, who know more of philosophy than I do, have to say on the subject. Hoping I have not trespassed too long on your space, L. B. K.

[By far the greater number of disputants appear to do their best to justify *Punch's* imperishable definition: "Toleration is letting you believe as I believe. Intoleration is your wishing me to believe as you believe."—ED.]

THE DOCTRINE OF CHANCES (Matthew xv. v. 14.)

[1637]—With regard to a letter of mine which you were good enough to insert in last week's KNOWLEDGE, concerning a problem in the calculation of chances, I regret to find that I am wrong, and that the solution given in "Whitaker's Almanack" is right.

I believe there is a saying at Cambridge that the chances are that a student who tackles a problem connected with the doctrine of chances will come to grief. I shall accept this caution in future, and not venture again to give an opinion on said topics.

CHAS. G. SHAW.

[I print this letter as containing a warning alike to myself and to the readers of KNOWLEDGE. It never occurred to me for an instant that any one would attack a mathematical deduction in so ably-edited a work as "Whitaker's Almanack" without being absolutely sure of his ground; and hence, pre-occupied as I am, I did not attempt to check Mr. Shaw's calculations. For the future, no mathematical or quasi-mathematical letter will be inserted until I have myself read it carefully through.]—ED.

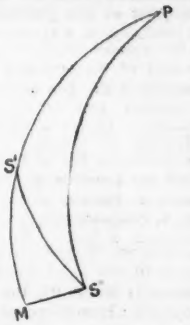
TERMITES AND NATURAL SELECTION.

[1638]—There are two points in Dr. Hutchinson's paper (p. 142) which should scarcely pass without notice. He says he believes the wings of termites are a provision of Nature for lessening the species, by means of its devourers in the air. Of course he is aware that our lamented "Illuminato" denies this doctrine. He holds that even the subtlest organs, such as the eye ("that most pure spirit of sense") are due to Natural Selection, and that this can never operate to the injury of the creature. Could not frost, disease, old age, or some other simple means, destroy the termites? What does the grand law of gradation say about the matter? Numerous species of ants and other insects eventuate in wings; is it in their case to cause their destruction?

A point even more important is that of the survivors, or rather slain. We here take notice, as in so many other cases (*e.g.*, shoals of fishes) that the survivors do not survive for Natural Selection—the unlucky are purely unlucky, not the weakest and worst. This I have always thought to be a weak link in the Darwinian chain. The whole question is by no means decided, but, on the contrary, still before the court. *Pendente lite*, we must still suspend our verdict. COMMENTATOR.

LETTERS RECEIVED AND SHORT ANSWERS.

COSMOPOLITAN is anxious to communicate with Mr. McMeister (letter 1619, p. 181) on the subject of inscribed rocks; and C. W. DYMOND, F.S.A., writes, in connection with the same subject, that rock-inscriptions, similar to those sketched by our correspondent, have been found in localities as widely separated as Scotland and Fiji! Failing any intimation of Mr. M.'s *locus in quo*, Mr. Dymond points out that it is impossible to say whether he has made a discovery or not.—A BEGINNER. When the Right Ascensions and Declinations of two stars are given, the angular distance between them is obtained trigonometrically, as shown in figure. Let P be the pole, and S and S′ our two stars. Then P S and P S′ will be their polar distances, and S P S′ the difference of their Right Ascensions (we will call this P). Draw S M perpendicular to P S′ produced. Then R. cos P = tan P M cot. P S. Hence tan. P M = cos P. tan P S. Further S′M = P M − P S′, and cos P M : cos S′M :: cos P S : cos S S′ (the angle we require). Let us illustrate this numerically. What is the angular distance to-night between Aldebaran R.A. 4h. 29m. 19·83s. and Dec. 16° 16′ 28·6″ N. (*i.e.*, Polar distance 73° 43′ 31·4″), and Sirius R.A. 6h. 40m. 5·76s. and Dec. 16° 33′ 57·1″ S. (*i.e.*, Polar distance 106° 33′ 57·1″)? Here we have given P. 2h. 10m. 45·93s. = 32° 41′ 28·95″, P S 106° 33′ 57·1″; and P S′ 73° 43′ 31·4″ to find S S′.



H.	M.	S.		°	′	″	
2	10	45·93	P =	32	41	28·95	cos 9·9251017
			PS =	106	33	57·1	tan 0·5265652
			PM =	109	27	58·15	tan 0·4516669
Subtract			PS′ =	73	43	31·4	
			S′M =	35	44	26·75	cos 9·9093785
			PS =	106	33	57·1	cos 9·4550236
			PM =	109	27	58·15	sec 0·4772299
			SS′ =	46	1	3·85	cos 9·8416320

So that Aldebaran and Sirius are 46° 1′ 3·85″ apart on an arc of a great circle. I have used 7-figure logs. for great accuracy, but we could have got within 0·7″ of the truth by employing 6 figures only. Try Ball's "Astronomy," in Longman's Text-books of Science.—J. WEBB. I do not fancy that the "coal sacks" have ever been specially treated of in any ordinary works on astronomy. See Sir John Herschel's "Cape Observations."—A CONSTANT READER. No; the Patent Law makes no provision for the man who keeps his invention to himself, whether it be his poverty or his will that consents to its concealment. You can buy any Act of Parliament from the Queen's printers, Messrs. Eyre & Spottiswoode.—W. G. WOOLCOMBE. I do not possess Williamson's "Dynamics." In its absence I cannot presume to dictate what you shall say to your pupils.—M. D. (Glasgow). We may take it that Jupiter's IVth satellite is 387,000,000 miles from the earth when at its nearest to us. You can compute the interval in miles between London and Glasgow by the formula just given above in reply to "A Beginner," and by an easy calculation gather the angle which that will subtend at that enormous distance! Why, what conceivable displacement *can* take place? Any discrepancies between the observed and computed times of the phenomena of Jupiter's satellite arise wholly from the imperfection of the tables (Damoiseau's) used for the computations in the *Nautical Almanac*. There are dynamical reasons why the earth's axis can never have shifted since she solidified. Perhaps you have come across some reference to Adhémar's vagaries.—JOHN B. GANSBY asks how to distinguish the male salamander from the female? He has two infertile ones in a vivarium, and, if they are both of one sex, wishes to procure a mate, or mates, for them. — P. W. RUDLER. Received with thanks.—EYE-WITNESS. With my limited capacity, I rather failed to see how things could be "totally different," and yet identical. Juggle with words as you may, your "mind," in the body, say of a girl of seven, would no longer be *yourself*. This Mind and Body discussion must now cease; we are drifting into the veriest logomachy.—DR. LEWINS. I am sorry to exclude your really able letter, with much in which I agree and sympathise, but really the subject has outrun all bounds.—LIMA. As the lectures were extemporaneous, perhaps you will quote the poem, or the first line of it; or give some hint as to its subject. Do you mean De Quincey's rendering of Richter's "Dream of Infinity," given on page 262 of Vol. III. of KNOWLEDGE?—GAUCHO.

XUM

I am unfortunately ignorant where the patent steel nose-band for horses can be procured.—R. L. Maith (or Marth, or Maitt[s]?). The Conductor of this journal simply gave his personal testimony to the *bona fides* of a system as far as his experience of it extended. He in no sense whatever can or will accept any responsibility for the acts of its professor towards other people.—Fleet-Surgeon Bradley, R.N. See reply to "Poulton-le-Fylde" and "M. J. H." in column two of page 116 of our current volume.—W. Pickard. Please read the reply to Dr. Lewins above as addressed to yourself too.—W. H. Godey very kindly sends the following list of lectures in course of delivery at Derby, under the auspices of the Gilchrist Educational Trust:—Jan. 21, Professor Seeley, on "Ice, and its Work in Earth-shaping"; Feb. 4, Professor Miall, "The Age af Reptiles"; Feb. 18, Rev. W. Dallinger, F.R.S., "An Hour with the Modern Microscope"; March 4, Mr. W. Lant Carpenter, "Principles of Electric Lighting"; March 18, the same lecturer, on "Electrical Storage and Transmission"; March 25, Professor Duncan, F.R.S., "Energies within the Earth: Mountain-making."—C. W. P., who has a 48-in. central-gear Sparkbrook tricycle, geared level, wishes Mr. Browning to tell him whether 56 in. would be too great a height for it to be geared up to, or whether 52 in. would be better. His own height is 5 ft. 9 in., and he is a light-weight.—W. F. Stanley. Unfortunately delayed for a week through being addressed to the Editor instead of the Publishers.—Augustus J. Harvey makes three suggestions: 1, That had we compulsory gratuitous national education, the needless waste of money incident in the purchase of a totally new set of books at every fresh school need never take place; 2, that the culture of edible fish in the lakes and rivers of the United Kingdom would add largely to our food supply; and 3, for the establishment of associated homes, to enable the middle classes to live in palaces instead of small and inconvenient houses. Combined with this is a more Utopian scheme still, to which no further reference is needed.—E. C. R., writing from County Meath in connection with Mr. McMeister's letter (1619) on inscribed rocks, suggests a comparison of Mr. M.'s sketch with drawings in a letter of his own (784) on p. 212 of Vol. III. of Knowledge. He alleges that inscribed monuments of this class are more numerous in Ireland than elsewhere; although they have been found in England, Scotland, and near the shores of the Baltic in a less rude and primitive form of sculpture. At Locmariker, in Brittany, are inscribed stones strongly resembling those of the great tumuli of Newgrange on the Boyne, referred to by our correspondent in his former letter. He invites attention to the fact that these inscriptions nearly always occur in connection with the burial of the dead. He further urges that drawings of them should be made for comparison, wherever possible, accompanied by a description of the kind of monument, locality, &c., and published in some journal of wide popular circulation; inasmuch as (as in the case of the inscribed stones in the Cairns crowning the highest point of the Sliabh na Cailliagh hills in Meath) atmospheric influences sooner or later weather all the incisions down to a dead level.—Adam Clarke Smith. I am extremely unwilling to do anything that shall present even the semblance of unfairness, but the insertion of your letter is absolutely impossible. Every question discussed in these columns must be so discussed in its purely *scientific* aspect. Dogmatic theology is utterly out of place here. Do you not see that if *texts* are to settle a controversy, there is an end of all argument at once, and that any appeal to reason becomes merely impertinent. If the man of science is to investigate the origin of the human race at all, he can, and must, only do so in the same spirit and by similar methods to those by which he would endeavour to arrive at the genesis of the Tumbler pigeon or the Dachshund. In your laudable efforts to maintain that the (so-called) Mosaic account of the Creation is historical and scientifically accurate, you are simply playing into the hands of the Infidel and the scoffer, and giving occasion to the enemy to blaspheme; inasmuch as it is in glaring contradiction to known and irrefragable facts. Suppose that before dogmatising upon the subject you make yourself acquainted with what is actually *known* as to primitive man. You could obtain no better primer for the purpose than Joly's "Man before Metals," in the "International Scientific Series." Are you aware that so earnest a Christian and devout a Catholic as Professor St. George Mivart freely admits the origin of man's existing bodily frame by development; while yet contending that his spiritual nature is a special endowment? You see that you cannot even claim a monopoly of Christianity for those who vainly imagine that mankind have all sprung from a single pair, miraculously placed on the earth some 6,000 years ago.—Thos. W. Delves. There are two ways of placing the figures, both perfectly intelligible without a diagram. The first is that universally employed in observatory clocks, in which the hours run from 0 (not 24) right round. The second may be adopted to any ordinary watch or clock face by painting XIII (in rather smaller figures) under the I, XIV under the II, and so on. This is very simple and inexpensive.—Mars. Write to Trübner, Lippincott, or any other American scientific bookseller in London about the "Popular Science Monthly," which is published in the United States. They would doubtless supply it. —E. W. Young. You begin by insisting on the impossibility of our regarding life otherwise than "as a force inseparable from a living body," and on our total inability to conceive mind apart from a thinking brain. So far your position is unassailable. But when you talk about forgetfulness of former events as an enormous change in a man's mind; and the soul (whatever that may be from a *scientific* point of view as distinguished from mind) constituting his "identity," you seem to me (forgive the expression) to be floundering a little. If my entire terrestrial existence is to become *tabula rasa*, it is assuredly no longer *I* who am to enjoy a future state. Admitting the probability of the existence of life in innumerable other worlds in the universe, it is hard to see, on your hypothesis, with *what* we are to live it. You remember the cherubs in the "Ingoldsby Legends," who "couldn't sit down—for they hadn't *de quoi*."—Sigma. Allow me to recommend Scott's "Elementary Meteorology," in the "International Scientific Series" to your careful perusal.—John A. Stewart. Thanks for Paisley paper duly received.—A. Barnes Moss. Will you be good enough to read the italicised paragraph on p. 473, and elsewhere, in the last volume of Knowledge?—John Silcock asks for an article on the Ornithorhyncus, Echidna, &c., from Mr. Grant Allen. See Vol. V., p. 269. The Ornithorhyncus has recently been conclusively proved to be oviparous. — Commentator. Undoubtedly suns and their attendant orbs are in all stages of formation in various parts of the universe, as probably as not the Pleiades, among them. Apart from the intrinsic improbability that any galaxy should be so placed that we should look straight at what you call its "butt end," and the practical impossibility that we should do so in several cases, do you not see that under such circumstances we should have no central condensation, but a homogeneous mass of light. Both Brewster and Mitchell were wrong as to their facts. Spectrum analysis was as unknown to the latter as the Queen's great grandchild. You can hardly describe a body like the sun, with its torrents of metallic rain, &c., as "a mass of glowing gas," in the sense in which a nebula can be so spoken of. The best proof we have that our sun, if removed to the distance of Sirius, would continue to exhibit the same spectrum that he does now, is found in the fact that Vega and other stars, no less than Sirius, exhibit the hydrogen spectrum, while those of Arcturus, &c., conform to the type of our own sun. Get the "Catalogo delle Stelle, di cui si è determinato lo spettro luminoso," by the late Father Secchi, published by Gauthier-Villars, Paris. You are mistaken in supposing that nebulæ are necessarily more remote than isolated stars. Some of them are doubtless nearer to us. Your question as to "what direction" the constellations are moving in is practically meaningless, since parts of them are moving in one direction, parts in another, and there is no up nor down, East, West, North, or South, *in space*. The term "fixed stars" is a convenient conventional one. They are called "fixed" to distinguish them from the appreciably moving planets. The night sky that Hipparchus looked out upon differs but little indeed from that visible as I write. —"Hallyards. There *is* a double star composed of two seventh magnitudes, some 3″ apart, in the spot you now indicate, which, if visible at all, would, of course, affect the eye as a single very minute point of light. It is 559 in Otto Struve's catalogue. I stand almost appalled at the infinity of space, but its contemplation scarcely affects me in the way you indicate. The use of science under the conditions postulated is to add to the knowledge and power of the human race, of which we form but infinitesimal atoms. An individual cell in an oak absorbs liquid and gas, and assimilates them, only to die; but it helps to build up a glorious tree notwithstanding.—Anonymous Correspondents send me the *Exeter and Plymouth Gazette*, and the *Huntley Express*, the latter containing a marked paragraph, in which (I trust unintentionally) a grossly inaccurate rendering of Professor Huxley's views is given, founded on a short isolated sentence, picked out of an essay of his written two-and-twenty years ago. Impartial people, with no preconceived ideas to support, are apt to speak a little rudely of this sort of garbling.—The Author of "Whist or Bumblepuppy." I have received your tiny volume, which (if breathing a little of the spirit of that pre-genetic race of whom Courier alleged that at the creation they exclaimed, "Mon Dieu, conservons le Chaos!") is as witty and entertaining as anything I have read for a long time. Fearing to "rush in where angels fear to tread," I have sent it straight on to the Conductor. — Sampson Low, Marston, & Co. Delayed for nearly a week through its having been addressed to a former private residence of the Conductor of Knowledge, instead of to this office.

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE *being a popular magazine*) *than is accorded by the most excellent trade journals.*

STEAM-COOKING APPARATUS.

[Patent No. 3,806. 1884.]—This apparatus, patented by Mr. W. Payne, and denominated the "Patent International Steam-Cooker," is very simple and handy. The upper figure illustrates the form designed for cooking potatoes and suchlike vegetables, the lower figure depicting the form for cooking fish, &c. The apparatus consists of three parts, the lower or outer vessel, in which water is placed sufficient to reach, but not cover, the strainer, on which the fish, vegetables, &c., are placed. The upper or inner vessel is simply a cover with a venthole in the top. It encloses the strainer and its contents, and dips into the water. Placed on the fire, the water is converted into steam, which speedily cooks whatever may be on the strainer. The apparatus is particularly useful, and certainly conduces very materially to the retention of the natural flavour of the food. At the same time, the fact of the parts being separate permits of the fish, or whatever it may be, being removed whole, a great point in the minds of cooks. The steam pressure may, within certain limits, be varied by altering the size of the steam-vent in the cover, while at the same time the looseness of the cover is a perfect safeguard against explosion in the event of the steam-pressure becoming excessive through reducing too much the size of the vent. Altogether our experience of Mr. Payne's cooker is a happy one, and we may safely commend it. Messrs. Moreton & Co., 23, Slaney-street, Birmingham, are the manufacturers.

LAPSABLE BOTTLE STAND.

[Patent No. 7,414. 1884.]—The subject of this patent, taken out by Mr. A. Watson, is a device for locking-up bottles containing spirits, scent, and such like liquids. The bottles are placed on a base provided with ends formed into handles (see "open" figure). Arms, hinged to these ends, are connected by metallic bars, which, to lock up the bottles, are brought together and locked in the centre. A handle is formed on the top by this means. The two figures will make this arrangement apparent. It will be seen that the bottles can be taken out without fear of chipping them, as the bars fall quite out of the way when unlocked. The manufacture has been entrusted to Messrs. Fairbairns & Sons, 65, St. Mary-axe, E.C.

Open.

Closed.

MECHANICAL GLOBE.

[Patent No. 7,044. 1884.]—This apparatus, patented by Mr. W. Rice, is designed to illustrate the varying lengths of day and night, the succession of the seasons, and other phenomena arising from "the inclination of the axis of the earth to the plane of its orbit." It consists essentially of an ordinary terrestrial globe, set at an angle of 23½° within a ring, in which it is free to be rotated, the ring itself being mounted on a vertical axis in a circular aperture in a black board or disc. By means of a simple appliance this ring can be rotated on its own axis, such rotation bringing successively to view every variation of the illuminated hemisphere caused by the earth's inclination during its annual revolution. The board, or disc, marks the boundary between the illuminated and dark hemispheres (*day* and *night*), and a fixed brass ball indicates the centre of the illumination, *i.e.*, the exact position of the sun's vertical rays. By rotating the ring in which the globe is suspended, it will be found that the dividing line is constantly changing within certain fixed limits, and the central point of illumination appears to travel across the equator from tropic to tropic. When the North Pole is thrown forward to its utmost extent (23½°), the position represented is that of the summer solstice (June 21), when the centre of illumination is on the northern tropic (Cancer). If this position be reversed, and the North Pole thrown back to its greatest extent (23½°), the winter solstice (Dec. 21) is represented, and the vertical rays of the sun now fall on the southern tropic (Capricorn). The two intermediate positions, with the sun exactly over the equator, are respectively the vernal and atumnal equinoxes (March 22 and Sept. 22). At the two equinoctial positions it will be seen that the sunlight extends from pole to pole, and during the rotation on its axis (from west to east) the earth has day and night of equal lengths in every part. This apparatus also shows clearly the distribution of solar light and heat throughout the year. By showing the two motions of the earth in combination—*i.e.*, by rapidly rotating the globe on its axis, and at the same time slowly turning it, by means of the ring, through the different phases—a very striking impression will be conveyed of the actual appearance of the earth in space; and the apparent path of the sun from tropic to tropic will be clearly demonstrated. The apparatus is made by Messrs. G. Philip & Son, Fleet-street, E.C.

XUM

Our Chess Column.

By Mephisto.

The following pretty game illustrates the powerful attack in one of the many interesting variations of the Algaier Gambit:—

Hampe Algaier.

White.	Black.
1. P to K4	P to K4
2. QKt to B3	QKt to B3
3. P to B4	P × P
4. Kt to B3	P to KKt4
5. P to KR4	P to Kt5
6. Kt to Kt5	P to KR3
7. Kt × P	K × Kt

Some authorities consider the attack arising from the sacrifice of the Kt on the 7th move to be more powerful in connection with 2. QKt to B3 than in the ordinary variation, without this move.

8. P to Q4	P to Q3

If 8. P to Q4, Black plays 9. Kt × P.

9. B to B4 (ch)	K to Kt2

Black may also play K to Kt3

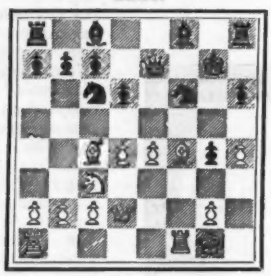
10. B × P	Kt to B3
11. Q to Q2	

Played with a view to command R6 and prevent Black from playing his KR and developing his game.

11.	Q to K2
12. Castles KR	

Preparing a deep laid scheme. If Black had played B to K2, White was prepared to Castle on the Q's side.

Black.



White.

12.	Kt × KP

Black falls into the trap.

13. Kt × Kt	Q × Kt
14. B × P (ch)	

This sacrifice is justified by the position.

14.	R × B

Forced; if K to R3, White mates in three moves.

15. Q to Kt5 (ch)	Q to Kt3

R to Kt3 would have been a far better move.

16. R to B7 (ch)	K to R sq.
17. R × B (ch)	K to Kt2
18. R to Kt8 (ch)	Resigns.

CHESS CURIOSITIES.

By Captain Verney. (Longmans.)

A very quaint book this, dealing mostly with four-handed and other Chess eccentricities. To the curious, the book affords plenty of specimens of Chess, distorted in all manners of shape. Four-handed Chess is ably dealt with by Captain Verney, a specialist on his subject, but of Chess itself, not much that is new or of particular interest to players is to be found.

A four-handed Chess club has lately been established at the Holborn Restaurant. Any person curious to learn what four-handed Chess is like will find the gallant Major and his friends, assisted by Mr. Hughes Hughes, as Hon. Sec., willing to give all information on club nights.

It is considered a maxim of etiquette among writers, perfectly well understood and observed by everybody, that every person is entitled to identify his writings by any signature or nom-de-plume he may think fit to choose.

The Chess Editors of the *Sheffield Independent*, *Bristol Mercury*, &c., seem, however, to think different, and very often publish Problems by "Mephisto," which, needless to say, are not composed by myself. Apart from the mystification caused thereby, I positively refuse to allow the suspicion to rest upon me any longer of having composed such a barbarous atrocity as appeared in that paper under the name of "Mephisto," the authorship of which has been ascribed to me by men whose opinion I value.—Mephisto.

We have received some gratifying expressions of opinion in regard to our End Game series. While not neglecting the Opening, we shall continue with End Games at various intervals.

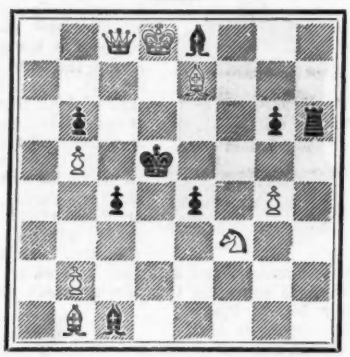
Chess at the Universities.—A combined team of twenty players of the Oxford and Cambridge Universities will play a match against the Third Class of the City Club on the 24th inst. On the 26th the annual match, Oxford *v.* Cambridge, will be played at the St. George's Chess Club. On the 25th and 27th two more matches will be played, *v.* St. George's and *v.* Brighton.

SELECTED PROBLEM No. 150.

By B. G. Laws.

(*Manchester Weekly Post.*)

Black.



White.

White to play and mate in three moves.

SOLUTION PROBLEM No. 149.

	1. Kt to B4	K to Q4
	2. Kt to K3 (ch)	Any
	3. B mates accordingly.	
Also	1. Kt to R4, &c.	

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

J. J. Cridlan.—White seems to have the better game: he ought to have withdrawn his Queen, and played to force the Queen's Pawn on.

Correct solution of Problem 149 received from M. T. Hooton, Toy, E. Louden, J. G. Powell, H. A. N.

End game solved by W., Ravenshoe, R. P. F.

Q. T. V.—How about P becomes a Knight?

H. W. Sherrard.—Problem received with thanks.

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NOTICES.

Part XL. (Feb., 1885), now ready, price 1s., post-free, 1s. 3d.

Volume VI., comprising the numbers published from July to December, 1884, is now ready, price 9s.

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